SPACE APPS FOR ANDROID

DISCOVER THE BEST ASTRONOMY AND SPACE APPS

Paolo Amoroso

Space Apps for Android

Discover the Best Astronomy and Space Apps

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Contents

Preface

I was an Android early adopter.

The purchase receipt of my HTC Magic running Android 1.5, my first smartphone and the second Android device ever produced, has the date of August 26, 2009 at 02:24pm. Google had unveiled the new mobile operating system in November 2007 and HTC had released the first consumer Android device in September 2008.

Back then I was already a longtime and happy user of several Google products and getting an Android phone was a no brainer. I instantly loved Android and, as I explored its nascent hardware and software ecosystem, I began looking for apps about my lifelong passions and field of work, astronomy and space. At the time there were only two astronomy apps in the Android Market, the ancestor of the Google Play Store. They were Google's own Sky Map and an astronomical clock.

Things remained the same for a long time, with only a handful of astronomy and space apps released. What really hurt was that, by then, there were already several cool astronomy apps for Android's lifelong rival iOS such as some slick 3D globes of the Moon and Mars.

Then Android took off and its app ecosystem with it.

I was also an early adopter of Google+, possibly Google's most well known and ill-fated social platform. I jumped in the first day it was unveiled on June 28, 2011 and started posting about astronomy apps for Android less than a year later in September 2012, continuing until the shutdown of consumer Google+ was announced in early October 2018. More and more such apps were being released and I shared my findings and experience with them.

In 2015 Google added collections to Google+, a feature for grouping posts by topic, and it was natural for me to create the collection *Space Apps for Android: Mobile space and astronomy* to organize my growing repertoire of astronomy app posts. In these posts I reviewed astronomy and space apps, reported news and updates, and shared my experience on how to use these apps.

I received a lot of positive feedback on the collection, possibly because space apps for Android are in a sweet spot at the intersection of two major geeky interests, astronomy and gadgets. Google featured my collection among the ones recommend to users, which helped it grow and gain many more followers.

By the time consumer Google+ was shut down for good on April 2, 2019, my *Space Apps for Android* collection had grown to almost 150 posts and over 240,000 followers.

I was burned out from investing so much effort into Google's major failed attempt at a social platform and decided to scale back my social efforts on similar platforms.

Although by then I had downloaded all my Google+ data, the posts of the collection were all lumped together in a big archive file along with other content from the almost 8 years I spent on Google+. It

wasn't easy to extract and repurpose the useful information I had put together about space apps for Android. And all that information was no longer public or accessible online. Not even to me, who frequently browsed or referred to the online collection myself.

Therefore, to make all this content more widely available I decided to put together all those posts in a handy single resource, revise them, add new material, and publish the result. It's the book you're reading now.

Introduction

This book is a guide to the best or most useful Android apps about astronomy, the universe, space exploration, and space science.

It provides an extensive series of reviews and information on many apps across a wide range of fields of astronomy and space. This is valuable because, although these apps make for great tools for knowing space and the universe, little or no documentation is available on many of them.

For several years I maintained on Google+ a collection of posts and reviews on the same topic. The book is based and expands on this collection of which it shares the name, revises the material, and adds new content.

The apps discussed here are available in the Google Play Store. The book also includes web apps, websites, and other resources that, although not native apps, are about astronomy or space and provide a good mobile experience on Android devices or add significant value. Although many of these apps work on most devices, given the computationally intensive nature of astronomy it's not unusual for them to require hardware configurations or software resources that only high-end devices or recent versions of Android have such as a fast processor, graphics hardware, or specific sensors.

The apps in the book cover the full spectrum of monetization options, from free apps to paid ones. I don't narrow my scope only to free apps because I respect the work and effort developers put into their apps and support them wherever possible. However, for security, privacy, and performance reasons I don't use apps that are available only as ad-supported and I don't discuss them here either.

Android apps run on many devices besides smartphones and tablets. Since 2017 a growing number of Chromebooks and other Chrome OS devices like Chromeboxes have been able to run Android apps. These devices add to the Android experience a desktop form factor and larger screens that were once limited to tablets.

Therefore the book also reports whether and how the apps work on Chrome OS. However, developer support is currently limited and not all astronomy and space apps work well on these devices, or at all.

Who is This Book For

Space Apps for Android is for amateur astronomers, space enthusiasts and anyone with a basic familiarity with astronomy and space. It may be useful also to educators as a guide to apps they can use in their astronomy teaching and lab activities.

Astronomy is a vast domain and covering it enough to understand how the apps discussed here work would require too much space and would be outside of the scope of this book. Therefore, this is not an introductory astronomy text.

How the Book is Structured

The apps discussed here are grouped into parts and chapters by field of astronomy or space such as planetariums, the planets, the Moon, artificial satellites, and so on. Each chapter opens with a brief

introduction and lists the apps in alphabetical order. An app entry contains some or all of the following subsections:

Download
    Links for downloading the various distributions of the app, typically a free version and possibly a paid one.

Usability issues
    Features, quirks, or limitations that make the user experience worse or reduce the app's effectiveness.

System requirements
    Hardware or software requirements such as the minimum version of Android the app runs on, any system components or sensors it requires, and so on.

Chrome OS
    Information on whether and how well the app works on Chrome OS. Unless otherwise noted tapping on the touch screen of a mobile device is equivalent to tapping the touch screen of a Chromebook if available, tapping the touchpad of a Chromebook, or clicking the left button of a mouse on non-touch Chrome OS devices such as Chromeboxes and Chromebases. So, for example, to tap and drag on a Chromebox you have to left-click and drag.

I tested the apps covered in the book on an ASUS Chromebox 3 with an Intel i7 processor and a Lenovo Yoga N23 Chromebook with a MediaTek processor.

Features
    An overview of what the app does and its key features.

Usage
    Usage notes. This is not a step-by-step guide but just enough information to find your way around the app and know where to look for to access the main features and useful resources. Apps change frequently and it would be impractical to provide up to date, detailed instructions.

Tips
    Tips and tricks on how to get the most out of the app, discover overlooked features, try interesting features, or work around limitations of the app.

Over the past years I tested the apps with a number of Nexus and Pixel Android devices by Google. As I write this, I have a Pixel 4 XL.

Conventions

I use text in a monospaced font `like this` for text labels, menu option names, or user interface elements in the app or in the Android operating system. You typically have to tap, drag, or otherwise interact with these elements in the app.

A series of text items in monospaced font separated by › such as `Option 1 › Option 2 › ... › Option N` is a sequence of menu options, button names, or other user interface elements you should interact with in the app one after the other.

A Living Book

I publish this book as a work in progress based on the Lean Publishing[1] process. As I expand and revise the book, the price will go up. But if you bought the book, the price won't go up for you and you'll get all future updates for free.

Book Status

This draft of the book is based on the original text of my Google+ collection *Space Apps for Android: Mobile space and astronomy* but removes the material that is no longer relevant or the now discontinued apps, adds a preface and an introduction, and revises and updates the content. Some app entries are missing part of the information or may not be up to date. Also, only a few of the entries report whether and how the apps work on Chrome OS.

Planned Content

I'm working to update the entries and add more material such as the introductions to each of the chapters and more app entries. I'll also include more extensive reports on whether the apps work on Chrome OS.

Again, if you already bought the book, you'll get all the new content for free. Be sure to turn on the option for receiving email updates on the platform where you bought the book. You can download the latest version by visiting your library on the platform, see the instructions in the emails notifications.

Feedback

If you find typos or incorrect information in the book, have suggestions, would like to tell me what you think of the book, or have other feedback, please let me know by emailing me at `info@paoloamoroso.com` or mentioning `@amoroso`[2] on Twitter.

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[1] https://blog.paoloamoroso.com/2019/07/leanpub-and-lean-publishing.html
[2] https://twitter.com/amoroso

Learn More

This book draws on my experience with Android and the Google ecosystem. Subscribe to my newsletter Practicing Google at `newsletter.paoloamoroso.com`[3] for weekly practical resources on Google products and related technologies. You will get links to tips, tutorials, apps, and other resources that will expand your Google toolbox and help you do more. You will also receive updates on this book and announcements of future books on astronomy, space, and Google.

I go in more depth on these topics on my blog `blog.paoloamoroso.com`[4] where I share my experience on Android, Chrome OS, and other Google products, and share my impressions on new astronomy and space apps. Be sure to follow the blog and subscribe to its RSS feed.

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[3] http://newsletter.paoloamoroso.com/
[4] https://blog.paoloamoroso.com

About the Author

Paolo Amoroso is an Italian astronomy and space popularizer, a Google expert, and a podcaster.

He has been doing astronomy and space outreach and education since the early 1980s, working at the Ulrico Hoepli Planetarium and the Brera Astronomical Museum in Milan. His activities ranged from lectures, observing sessions of the sky with Giovanni Virginio Schiaparelli's historical 8" Merz telescope, guided tours of astronomical facilities and space exhibitions, to teaching astronomy at a Prada Foundation art exhibition.

Paolo wrote the official Italian translation of the training and mission Logbook of ESA astronaut Samantha Cristoforetti and the glossary of her autobiography, *Diario di un'apprendista astronauta*.

As part of his space outreach activities he has been a co-host of AstronautiCAST, the first Italian space podcast, since its beginning in 2007. He is also a board member of AstronautiCAST's parent organization ISAA, the Italian Space and Astronautics Association.

Paolo has been a member of the Google Top Contributor Program and later the Product Experts Program since 2014. In 2016 Google invited him as a founding member of the Google+ Create program.

Visit Paolo's website `www.paoloamoroso.com`[5] and blog `blog.paoloamoroso.com`[6], where he shares his experience with Google products as well as astronomy and space apps. Subscribe to Paolo's newsletter `newsletter.paoloamoroso.com`[7] for weekly practical resources on Google products and related technologies.

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[5]https://www.paoloamoroso.com
[6]https://blog.paoloamoroso.com
[7]http://newsletter.paoloamoroso.com

The Solar System

Earth Observation

It's almost cliche to say artificial satellites changed our lives.

These orbiting spacecrafts are among the most well known benefits of space exploration as they give us practical help with weather forecasts, telecommunications, navigation, and monitoring our planet and its resources. However, we rarely see or use satellite data directly.

Google Maps made satellite imagery popular despite not all of its views having been taken from space. But there's more to satellite data than just the images in mapping tools and the apps in this chapter are examples of the visualizations and interactions these data make possible.

The European Space Agency (ESA) runs a number of Earth observation programs and satellites and publishes official apps for accessing some of the data they collect such as Copernicus Sentinel and ESA cryosat. Checking these data lets you understand how our planet and its environment work, for example by looking for seasonal or other patterns.

There's something more you can learn from these apps. They give you a glimpse at the complexity of orbital operations, satellite tracking, and data transmission. Using these apps is also an opportunity for knowing better your country and local area as well as how it changes. We all do "vanity searches" in Google Maps for the places we live in, have been at, or are familiar with. Try for example similar searches in Earth imaging satellite apps, particularly SnapPlanet that is designed as a social tool and provides content that's great to share to your favorite social platforms.

You can also see satellites with your own eyes and a later chapter covers the apps that help spot these and other space vehicles in the sky.

Copernicus Sentinel

Copernicus Sentinel is the official app of the European Sentinel Earth observation satellites. The European Space Agency (ESA) is developing a series of missions on behalf of the ESA/European Commission Copernicus[8] joint program.

Download

- Free[9]

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[8]https://www.copernicus.eu/en
[9]https://play.google.com/store/apps/details?id=esa.sentinel

Chrome OS

Copernicus Sentinel works on Chrome OS. However, on my Chromebox the play button of the videos in the app's media screen does nothing.

In some cases the window's `<-` title bar button or the device's `Back` key exit the app instead of going back to the previous screen. I haven't found a suitable workaround other than re-opening the app or using the side menus for navigation.

To rotate the 3D globe in the app's screens you can swipe with two fingers left or right and up or down on the touchpad of a Chromebook. The long-tap gesture of touch screens used in some of the views of Copernicus Sentinel can be obtained by long-clicking the touchpad of a Chromebook or long-clicking the mouse of a Chromebox. Also on non-touch screens use the mouse wheel to zoom.

Features

The app lets you track the satellites of the Copernicus program along their orbits, explore 3D models of the spacecrafts, learn about the missions, view images and access data products such as data sets.

Usage

Four menus, one at each side of the screen, control the Copernicus Sentinel app. Tap the buttons looking like a vertical bar | at the left and right side to bring up the respective menu. The other menus are in view most of the time, tap the up or down arrow icon that replaces them if not.

The top menu is a satellite selector. Tap the one you're interested in to view its orbits and data or `ALL` for all of the satellites. The right menu lets you change the date and time by sliding up or down the pickers for the various parts of the day and time, such as the month or hour.

The `Tracking` option of the bottom menu shows a real-time simulated globe of the Earth with the orbits and positions of the satellites. Tap and drag to explore the globe, pinch to zoom. Twist two fingers to rotate the view.

Tap `Acquisition` to visualize the satellite signal acquisition areas of the ground stations, tap an area to get more details on the acquisition times and related data. Although it's not intuitive the `Acquisition` screen provides a simple way of viewing the images taken by the selected satellite. Just long-tap a point on the globe and the app will pop up a menu of data sets, if available. Tap one to display the corresponding image, as well as another menu that lets you switch to the previous or next image (`<-` or `->` buttons) or play an animation of a sequence of images of the area (play button).

The `Achievements` option opens the Copernicus program's hall of fame. There's a marker for the areas of the Earth where Copernicus satellites collected important data to help address environmental issues or where they are being used to do something notable. Tap a marker for more information.

Tap `3D model` to interactively explore 3D models of the satellites. Tap and drag to rotate a model, pinch to zoom. Switch to a different satellite through the satellite selector at the top of the screen.

The `Mission` option has links to external websites with information on the Copernicus program missions. Tap the section you're interested in.

In the `News` tab you'll find links to more external websites with news and updates on the Copernicus missions. Tap the sections you're interested in.

The `Products` option of the bottom menu lets you access the data products of the Copernicus program hosted on external websites such as images or data sets. Sentinel data are free to access but creating an account is required.

The `Statistics` screen shows at a glance how much of the data of the selected satellite is available in a given area.

The options in the `Settings` screen let you turn on system notification for satellite passes and the releases of new data products, set your location, or change some of the app's visualization preferences.

The `About` tab provides information on the app and a button for sending feedback.

The menu at the left edge of the screen has options for visualizing satellite passes over your location and getting signal acquisition information.

Tips

Some of the app's screens show a tutorial overlay you can dismiss by tapping the `X` icon.

The menus have more options than fit on a typical screen, especially when the app's window is not maximized on a Chrome OS device. Therefore, to view more options swipe the menu along its major dimension.

On a Chrome OS device the app may not be able to determine your location but you can set the geographical coordinates manually under `Settings` > `Custom Location`.

If you look carefully among the stars on the background of outer space you'll spot the other planets of the Solar System, be sure to rotate the view to see all of them.

Earth Viewer

Earth Viewer is an app for visualizing data from Earth observation satellites. It combines a simple user interface with a wealth of data and an effective visualization but it requires some research to understand what its data sets are supposed to measure or mean.

Download

- [Free[10]](#)

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[10]https://play.google.com/store/apps/details?id=mobile.application.forfree.earth

Chrome OS

It works on Chrome OS. When the window is maximized the app doesn't take advantage of the full screen but the Earth globe is large enough.

Features

Earth Viewer displays on a globe up to date environmental satellite data sets and weather forecasts. The data come from satellites of the major space agencies and environmental institutions.

Usage

The main screen shows a globe of the Earth and its solar lighting conditions at the current time. Tap and drag to rotate the globe. Double-tap to start animating the selected data set, double-tap again to pause it.

The 3-dots menu icon has options for switching the view to a different data set, resetting time, turning off live lighting, and starting/pausing the animation.

Tips

Earth Viewer comes with no preloaded data sets as the ones it uses are continually updated. You have to explicitly download the data sets you want from the 3-dots menu icon. Downloading consumes mobile data as well as local storage and may take some time even with a fast Internet connection, so be sure to do it over Wi-Fi.

`XPLANET static` is a beautiful data set that shows a realistic view of the Earth. But it's just a static image and it doesn't update.

ESA cryosat

The European Space Agency (ESA) CryoSat[11] Earth observation program has an official app, ESA cryosat. It's a great app with rich, insightful, up to date data and orbital elements.

The CryoSat program operates CryoSat-2, an environmental satellite for monitoring the polar ice caps, changes in ice thickness, and other geophysical parameters.

Download

- Free[12]

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[11]https://www.esa.int/Our_Activities/Observing_the_Earth/CryoSat
[12]https://play.google.com/store/apps/details?id=it.acsys.android.esacryosatapp

Chrome OS

The app works on Chrome OS.

Although it's not optimized for large screens and layouts the app's window can be scaled to the full screen and the content reflows to use reasonably well all the available space. However, the images are scaled up too and some small ones look pixelated. Resizing the window requires restarting the app, just select the restarting action when prompted by the system dialog.

Zooming is not supported on non-touch screens.

Features

ESA cryosat provides information and news on the CryoSat-2 mission as well as the spacecraft. You can also track the satellite and visualize the data it acquires.

Usage

The main menu is the toolbar at the bottom of the app's screen. All the mission information, news, photos, and videos are under `Mission`.

The `3D model` option shows an interactive 3D model of the spacecraft, its instruments, and its subsystems. Tap and drag to rotate the model, pinch to zoom. Under `Payload and Platform` tap a satellite component to select it and then the `(i)` icon to show the related information.

The `Tracking` option displays the current position of the satellite in the `View` tab, its visibility from ground stations under `Visibility`. Tap and drag to rotate the Earth's globe, pinch to zoom.

Access a rich collection of data sets from CryoSat-2 measurements through the `Data` option of the main menu. After selecting a time range tap `Products` › `Variables` › `Options` to pick a data set and have it plotted along an orbit around a globe of the Earth. A slider lets you adjust the scale of the data plot on the globe.

Slide the data chart to the left or right to move the satellite position marker along the selected orbit.

Tips

The main menu has more options than fit on a typical screen, especially when the app's window is not maximized on Chrome OS device. Therefore to view more options swipe the menu horizontally.

To change the date or time in the `Data` screen you need to tap and drag vertically the relevant selector.

One of the most interesting variables of the `Data` screen is `Solid Earth Tide`. This data set records the vertical displacement of the Earth's landmasses due to the gravitational effects of the Moon and the Sun, which are orders of magnitude less than the more well known sea tides. Have a look at these unusual data.

When viewing a data set tap the letter envelope icon to share the data. Only a few Android sharing options are available, such as sending to Gmail or Google Drive.

SnapPlanet

SnapPlanet is a social app for creating and sharing views of the Earth from satellite images It's the [winner of ESA's 2017 Space App Camp](#)[13] in Barcelona, Spain, a competition initiated by the European Space Agency (ESA).

This is a great idea and app with a couple of issues. The first is text is often too small and unlegible. Further, the app doesn't support the standard Android system sharing functionality and provides limited options for only the most popular platforms such as Facebook and Twitter.

Download

- [Free](#)[14]

Chrome OS

SnapPlanet doesn't work on Chrome OS.

Features

The app lets you browse images taken by ESA's Earth observation satellites of the Copernicus program, particularly Sentinel 2A. You can create your own views, compare changes of an area over time, and share the images.

A notable feature is the ability to create time-lapse animations made from a sequence of images. This can be insightful to see how the weather changes in the short term or the surface of our planet evolves in the middle to long term.

Usage

The main screen has five main tabs with options for checking a feed of the images shared by other users (home icon), exploring the latest and most popular images (magnifying glass icon), creating images of specific areas (camera icon), reviewing your notifications and activity (bell icon), and changing the preferences (person icon).

Tap a thumbnail to view the corresponding image. The screen you get when opening an image has icons for comparing the current view with other dates (double-tipped arrow), liking the image (heart icon), sharing it (box with an arrow icon), or changing the account and app preferences (person icon).

In the image capture screen tap the crosshair icon to center the view at your current location, the shuffle icon to go to a random location, the magnifying glass icon to search for a specific address, or the Earth icon to get the satellite view of the current area of the map like in Google Maps.

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[13]http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/SnapPlanet_app_wins_top_prize_at_Space_App_Camp
[14]https://play.google.com/store/apps/details?id=io.snapplanet.app

To make a time-lapse animation tap the camera icon on the main screen, tap the shutter icon, tap `Animation`, and pick from six to twenty images of the same area. You can optionally select a filter, adjust the brightness, set the animation speed, and add tags and a comment. To make the animation tap `Snap !`.

Tips

You must have an account to use the app but you can create one using your account on one of the major identity providers and social platforms such as Google and Facebook.

To share to an unsupported social platform or app tap the sharing icon and pick the `Copy link` option. You can then paste the link into the app or platform.

To cancel the edit or sharing dialogs without changes tap anywhere outside of the dialog area.

For better results, when making animations pick images with limited weather or cloud coverage changes across consecutive frames, otherwise there won't be any recognizable areas or features and the animation will look jerky. If an animation doesn't have many frames it's better to set a slow speed.

The Moon

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LunarMap

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Eclipse Calculator 2

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The Planets

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