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Planck Flies!

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Editor's Introduction

Here, hot off the press (as they used to say in the days when newspapers were not endangered), is a report from South America by the President of the Astronomical Society of the Pacific, on the launch of the Planck and Herschel scientific satellites. For more on the cosmic background radiation, please see issue 22 of *Astronomy Beat.*

As you may have read in the ASP's *Astronomy Beat* column #22, I have for many years been involved in the planning and development of a large European satellite project, the Planck mission (see http://www.rssd.esa.int/Planck and Figure 2). Planck is the third generation space mission to explore the cosmic microwave background radiation (CMBR), the residual heat of the Hot Big bang origin of the Universe. It will image the entire sky in exquisite detail in a wide range of frequencies from 30 to 850 GHz. The science yield should be immense — a precise measurement of the curvature of space, tight constraints on the amount of Dark Matter and Dark Energy in the universe, and perhaps even the first detection of a direct imprint of an early period of inflationary expansion of the Universe. The last of these will appear as a faint signal in polarization of the microwave background, and Planck 's CMBR receivers are polarization-sensitive.

It is a relief to report that the jinx I discussed in column 22 did not operate in this case — so far. This complex and beautiful mission, sponsored by the European Space Agency with significant contributions from NASA, was successfully launched on May 14 from the Centre Spatial Guyanais in French Guiana. Along with several other US members of the Planck team and many European colleagues, I was there for the launch. Here is a brief personal report for ASP members on how it went:

Figure 1: Your author in front of full-scale replica of the Ariane 5

Our Air France flight came in over the backcountry of

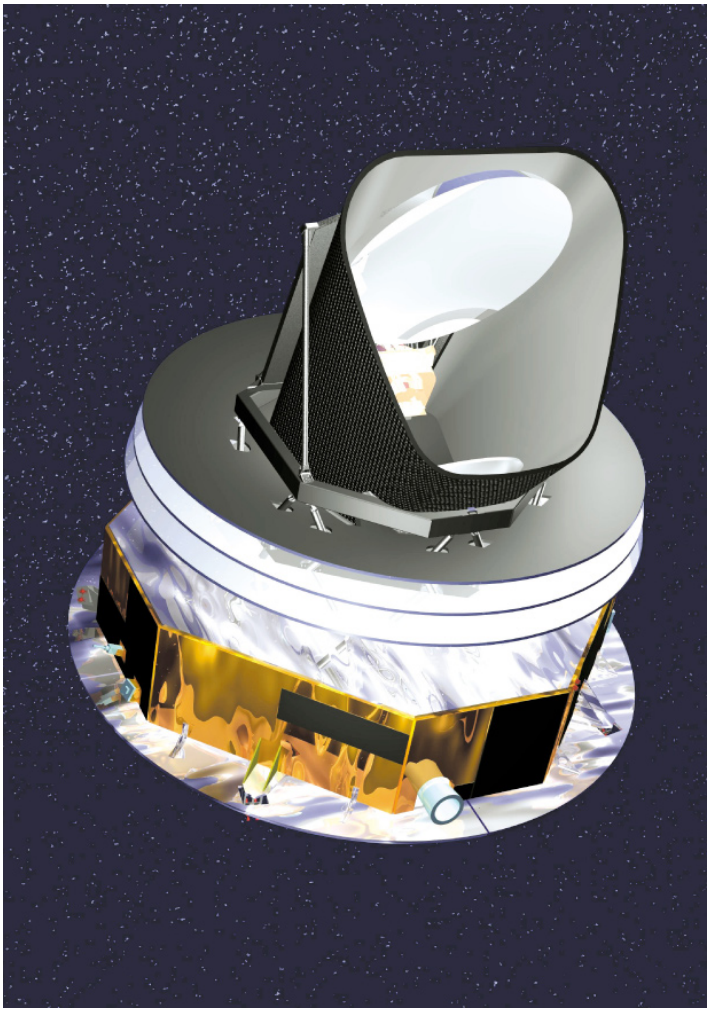

Figure 2: The Planck satellite as it will look on orbit.

French Guiana. Looking down, the jungle looked like a billion heads of broccoli seen from above, unpeopled and unmarked except for some lazy, brown rivers. I was picked up at the modern airport of Cayenne by some fellow scientists and driven directly to the European Spaceport near Kourou for a tour of the facilities. The contrast between the high-tech launch facilities and the jungle visible on the horizon was sharp. I was stuck by the professionalism of the launch staff, and also by the extraordinary security precautions surrounding the spaceport: not only were the French Gendarmerie, army and air force employed, we and our launch vehicle were being protected by the French Foreign Legion! With more than two billion dollars of hardware sitting in the hangar, they were taking no chances. The same was true with safety aspects. When we got close to the launch site, we were all issued gas masks in case something bad happened. (See the earlier AstroBeat to see why gas masks have a certain resonance for me.)

The next day, May 13, at midmorning, they rolled out the Ariane 5 launch vehicle with both the Planck satellite and the Herschel telescope aboard. The whole assembly, including the 56-meter high Ariane 5 and its two solid boosters was carted out in a vertical position, and at a surprisingly rapid clip (see Figure 3). Since Herschel was charged with liquid cryogen (for cooling the instruments that will observe infrared radiation), it was important to reduce the time between the roll-out and the launch, since every minute sitting on the pad meant more evaporation in the tropical heat. The launch staff worked overtime to make the transition quick, and all night long to ensure that we were ready

Figure 3: The business end of the rocket during roll-out. Right below the word "Planck" is a small blue rectangle. This, I am happy to say, is the logo for the International Year of Astronomy, in which the ASP is so fully involved.

Figure 4: We're off! This spectacular picture was taken from our viewpoint, 8 miles away, by Charles Lawrence of NASA's Jet Propulsion Lab, a Planck Team Leader.

for launch the next morning. Planck and Herschel's rendezvous with destiny was set for shortly after 10 a.m., May 14. The launch window was narrow — opening at 10:12 and closing at 11:07 local time.

As one can imagine, a lot of us were nervous the night of the 13th. I have no recollection of the evening meal except that lots of local rum was involved. The next morning, I woke early, fretting about the weather. After all, Planck represented 16 years of my life, and the effort of hundreds of scientists and engineers. Would it go off on time? Would it go off at all? I recognized my state of nerves when I found myself checking the weather for the fourth time in the 7 minutes between awakening and getting into the shower.

Well, it was a good thing I checked the weather. While we were waiting for the buses to take us to the site from which we could view the launch, a torrential downpour occurred. Soon there was another. Eventually, we were bused up to a site 7 or 8 miles from the launch pad (a closer site was reserved for the truly important people, like journalists and politicians — but we scientists still got a good view from a small hill). When we arrived, the rain showers had ended, but the cloud cover was substantial and the temperature stifling.

About 20 minutes before the launch window opened, the skies brightened and were mostly clear both over our heads and, more importantly, over the launch pad. Some minutes before launch, video coverage of the control room came on, and the countdown sequence began, in French of course. All of us were straining to see the tiny, pale speck representing the Ariane 5 and all our hopes. Very early in the launch window, we saw the telltale plume of white exhaust squirting out to the side and then, a few seconds later, a bright orange tongue of flame as our 800 ton, two billion-dollar-project lifted off forever (see Fig. 4). All of this was of course utterly silent since we were so far away, and it was also surprisingly slow moving (it took a while to shed enough mass so that the acceleration was rapid). If you want to see a re-run of the launch, look for "Ariane 5," then "The Lift Off" at www.videocorner.tv.

About the time the Ariane was beginning to arc to the east into a tropical blue sky, the sound reached us. I would describe it as a sort of a crackly roar. Imagine a deep rumble accompanied by the frenzied crumpling of stiff paper or the very rapid flapping of a flag in a high wind — that was the sound. We all took pictures madly (see Figure 3) and watched as our baby plunged into a cloud where it was hidden for something like 10 seconds. Then it emerged in a glorious lazy curve towards the sun in the east. I lost it in the glare, but one of my colleagues claimed to have seen the two solid boosters detach about 2 minutes and 20 seconds into launch, when the Ariane was well above the atmosphere.

A few minutes later we heard that the shroud protecting the two satellites had successfully departed, and we stopped staring at the exhaust trail (Fig. 5) and crowded around the video screens to hear about the next, and crucial events: would the rocket reach the velocity necessary to send the two satellites out to their final "orbit" at the second Lagrange point* a million miles from the Earth? Would the two satellites separate from each other, or waddle off into space bound together, a catastrophe for both? The first satellite to spring loose was the Herschel telescope — a round of applause. Then another anxious minute or two and the Planck satellite sprang loose and began its 40–50-day slow

* "L2" is a point on the Earth-Sun line, 1.5 million km beyond the Earth; it was selected so both the Earth and Sun will be behind Planck, and thus out of the way, as Planck scans the skies.

Figure 5: A minute or two later.

coast to the second Lagrange point. More applause, and a few bleary eyes, mine included. I found myself wondering what my father, an amateur astronomer who introduced me to astronomy, would think of all this.

Once the separations had occurred, the speeches started, and most of us got on the bus to go off to a grand and rum-stoked celebration. Fortunately for my head, I missed that one, since the Astronomical Society of the Pacific managed to schedule a teleconference of the Board of Directors meeting on exactly the day of the Planck launch. So while others were celebrating, I was presiding over a Board meeting on a scratchy phone line from Kourou (and, I confess, during the breaks taking a swim in the hotel pool).

At the time of this writing, Planck is working "like a Swiss watch," to quote my boss on the project, Reno Mandolesi of IASF in Bologna. May that continue!

About the Author

Bruce Partridge is the new President of the ASP. He taught for many years at Haverford College, and his research interests lie in radio astronomy and cosmology, particularly in the study of the 3 K cosmic microwave background radiation. He also served as Education Officer of the American Astronomical Society and organized two national workshops where chairs of astronomy departments discussed the teaching of introductory astronomy.

Resources for Further Information:

Planck Mission Page:
http://www.esa.int/science/planck ✦