hurdles for planet-formation models. Nonetheless, he adds a note of caution: "Pebble accretion models are still in their infancy. The new work is definitely a substantial step forward, but it is not the last word on the subject." For example, Chambers points out that having the growth rate of pebbles as a control knob is somewhat artificial.

Although Levison wouldn't disagree, he explains that IR observations of protoplanetary disks around young stars show that dust in those disks lasts for millions of years. Those observations could justify the idea that pebbles slowly form out of the dust, even if the exact process is not understood.

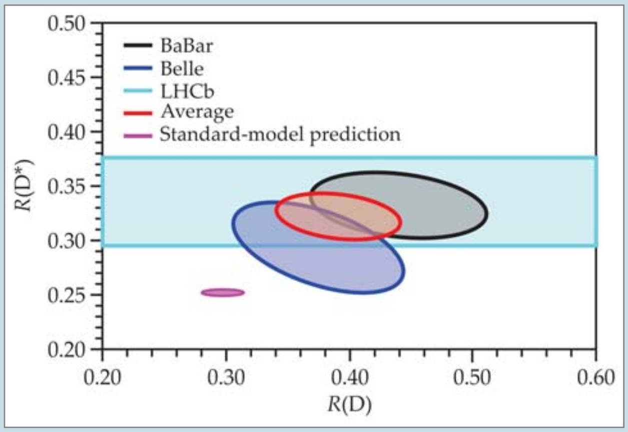
In addition, planetesimals should, in principle, form alongside the pebbles instead of being present from the start. However, the group decided to add them at the beginning for simplicity. The simulations were already computationally expensive, with runs taking weeks to finish. "We don't expect the qualitative results to be any different between the two ways," Duncan says.

In the meantime, the group is moving forward with extending their model inward in the solar system—their initial simulations had an inner edge just inside the giant-planet region, again for reasons of computational cost. They're checking to see if the asteroid belt between Mars and Jupiter survives planet formation through pebble accretion. And they are investigating how pebble accretion might apply to the formation of the terrestrial planets. Says Levison, "We're moving around the solar system, trying to see where pebble accretion works and where it doesn't."

Sung Chang

References

1. M. Lambrechts, A. Johansen, *Astron. Astrophys.* **544**, A32 (2012).
2. K. A. Kretke, H. F. Levison, *Astron. J.* **148**, 109 (2014).
3. H. F. Levison, K. A. Kretke, M. J. Duncan, *Nature* **524**, 322 (2015).
4. A. Youdin, J. Goodman, *Astrophys. J.* **620**, 459 (2005); A. Johansen et al., *Nature* **448**, 1022 (2007).
5. C. W. Ormel, H. H. Klahr, *Astron. Astrophys.* **520**, A43 (2010).



Now the LHCb collaboration at CERN has confirmed the BaBar result for one of the decays. In a preprint, the Belle group at KEK in Japan has also announced results that show a similar though less strong deviation from the standard model. The figure (from the Heavy Flavor Averaging Group) shows the branching ratios (R) measured by the groups for the two decays, denoted D and D*, along with the standard-model prediction. Taken together, the groups' measurements have struck a 3.9-σ blow to the principle of lepton democracy. If they hold up, the standard model will have to be modified—perhaps by the addition of a new charged Higgs boson, whose interactions would depend on mass. (R. Aaij et al., LHCb collaboration, *Phys. Rev. Lett.* **115**, 111803, 2015.) —SKB

Point-of-care blood tests with microfluidics. Blood tests are widely used to diagnose and monitor diseases, medication effectiveness, and organ function. Most analytes reside in the plasma, blood's liquid component, and the separation of plasma from blood's solid components typically entails sending blood samples to processing labs for centrifugation. But microfluidics offers the prospect of running tests on location, at low cost, with mere droplets of blood fresh from a pricked finger—by spinning ("lab on a CD"), wicking in ordinary paper, or incorporating filters into "labs on a chip." Jasmina Casals-Terré (Technical University of Catalonia) and colleagues have now addressed a major hurdle for so-called cross-flow microfluidic filters and greatly improved their efficiency. In the team's device, blood from an injected drop flows through a narrow, 2-cm-long channel. An electric field applied to the channel helps drive the flow electro-osmotically (see the article by George Whitesides and Abraham Stroock, PHYSICS TODAY, June 2001, page 42). On each side of the channel, half a millimeter away, are parallel channels to carry plasma to the testing region. Separating the channels is an array of diamond-shaped micropillars—each 50 µm wide, 200 µm long, and separated by 30 µm—that filters out the red blood cells. As in other filtration devices, the cells will clog the filter entrance. But every 30 seconds, the team reverses the field direction for 5 seconds, just long enough to break up the accumulating cells. With those electro-osmotic flow reversals, from a 10-µL droplet of blood the researchers could collect 1 µL of plasma in 5–8 minutes. That's enough plasma, they show, to run a blood panel comprising multiple tests. (M. Mohammadi, H. Madadi, J. Casals-Terré, *Biomicrofluidics* **9**, 054106, 2015.) —RJF

Fast electrons in the night sky. Atoms and molecules in Earth's upper atmosphere are ionized by UV photons from the Sun. The layer of plasma that results—the ionosphere—has a temperature of about 2000 K, equivalent to a thermal energy kT of around 0.2 eV. By contrast, the photoelectrons that are kicked out during ionization have energies of around 10 eV. When those fast electrons whiz through ionospheric plasma, they excite waves. Thanks to the waves' motion, a radar beam bounced off the ionosphere acquires frequency-shifted side lines on its return. Such "plasma lines" are strongest when the Sun is shining. Indeed, it was a surprise when in 1982 Herbert Carlson of Utah State University detected weak plasma lines at night in the skies above Arecibo Observatory. Now Carlson has returned to Arecibo with the aim not just of detecting and characterizing nighttime plasma lines but also of determining their origin. Because Earth's magnetic field lines funnel fast electrons, Carlson and his collaborators had to ensure that they made their observations when the other, Southern Hemisphere end of the field line that arcs over Arecibo was also in darkness. From their observations, conducted in February of this year, the researchers discovered that nighttime plasma lines are frequent and variable. Although the source of the fast electrons that engender the lines remains unclear, one strong possibility is leakage from Earth's radiation belts. (H. C. Carlson et al., *Geophys. Res. Lett.*, in press.) —CD ■