

# This Week's Finds in Mathematical Physics (Week 228)

---

*Source:* <http://sci.tech-archive.net/Archive/sci.physics.research/2006-03/msg00155.html>

---

- *From:* [baez@xx](mailto:baez@xx) (John Baez)
  - *Date:* Mon, 20 Mar 2006 03:39:57 +0000 (UTC)
- 

Also available at <http://math.ucr.edu/home/baez/week228.html>

March 18, 2006

This Week's Finds in Mathematical Physics (Week 228)

John Baez

Last week I showed you some pretty pictures of dunes on Mars. This week I'll talk about dunes called "barchans" and their relation to self-organized criticality. Then I'll say a bit about Lauscher and Reuter's work on quantum gravity... and then I'll beg for help on a topology problem involving so-called "rational tangles".

But first, a demonstration of my psychic powers.

Take any book off the shelf and look at its 10-digit ISBN number. Multiply the first digit by 1, the second digit by 2, the third digit by 3 and so on... up to the NEXT TO LAST DIGIT. Add them up.

Then take this sum and see what it equals mod 11. At the end of this article, I'll say what you got.

Okay. Here's a photo of the icy dunes of northern Mars. I love it because it shows that Mars is a lively place with wind and water:

1) North polar sand sea, Mars Odyssey Mission, THEMIS (Thermal emission imaging system), <http://themis.mars.asu.edu/features/polardunes>

These dunes, occupying a region the size of Texas, have been sculpted by wind into long lines with crests 500 meters apart. Their hollows are covered with frost, which appears bluish-white in this infrared photograph. The big white spot near the bottom is a hill 100 meters high.

Where the dunes become sparser – for example, near that icy hill – they break apart into "barchans". These are crescent-shaped formations whose horns point downwind. Barchans are also found on the deserts of Earth, and surely on many other planets across the Universe. They are one of several basic dune patterns, an inevitable consequence of the

## This Week's Finds in Mathematical Physics (Week 228)

laws of nature under fairly common conditions.

The upwind slope of a barchan is gentle, while the downwind slope is between 32 and 34 degrees. This is the "angle of repose" for sand – the maximum angle it can tolerate before it starts slipping down:

2) Wikipedia, Barchan, <http://en.wikipedia.org/wiki/Barchan>

Wind-blown sand accumulates on the front of the barchan, and then slides down the "slip face" on the back.

Barchans gradually migrate in the direction of the wind at speeds of about 1–20 meters per