A memorable exchange[9] between Mike Dworetsky and Georges Alecian at the 2004 International Astronomical Union Symposium in Poprad, Slovakia, anticipated the remarkable results for α Andromedae reported here. Dworetsky asked Alecian, a theorist, whether the huge (two orders-of-magnitude) range of Fe abundances in the HgMn stars imply a range in the equilibrium abundances in their atmospheres or whether they are simply 'abundance snapshots' of stars whose atmospheres evolve with time in a complicated way (like the weather). Alecian replied: "In my opinion, clouds of metals in optically thin layers could disappear and form again. Therefore, the abundance scatter that you mention should not correspond to any equilibrium abundances." Dworetsky was asking about Fe, one of the naturally most abundant metals in nature. Alecian's answer was couched in the language of clouds. And he certainly would have given the same answer for Hg.

If Alecian is correct, the chemical inhomogeneity of HgMn stars may be nothing more than the time-series equivalent to blind men examining an elephant. They each touch different parts of the elephant and report different properties, but they are all talking about the same elephant. In the astronomical context we observe various HgMn stars at different times in their various weather cycles and draw similarly disparate conclusions. Most of the currently known HgMn stars have rotation velocities considerably smaller than that of α Andromedae, in part at least because observational bias tends to produce such a list. The Doppler imaging technique discussed by Kochukhov *et al.*[1] cannot be used for the slow rotators because their linewidths are too small. However, if the abundance clouds are secularly unstable, in the manner of terrestrial clouds, they may crash (rain down) from time to time to produce secular variations in abundances, which might be detectable, if we look long and hard enough. Thermohaline mixing[10] that drives terrestrial ocean currents comes to mind. The timescale of such variations may be tied to rotationally induced atmospheric circulation patterns, so we must search for these variations on currently unknown timescales. And I, being 77 years old, happily bequeath this task to my successors.

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COSMIC RAYS

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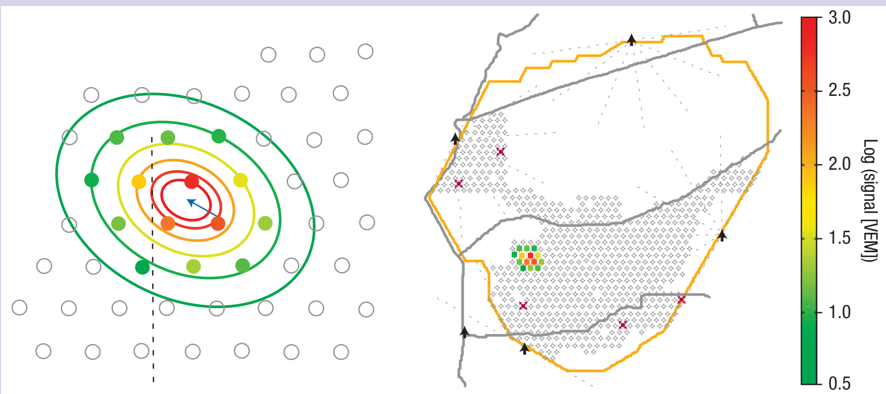

PIERRE AUGER OBSERVATORY

The Pierre Auger Collaboration is making its data available online. Starting last month, about 70 cosmic-ray events are being posted every day on their website. This outreach exercise is intended to engage the public with research as it happens — but physicists might be curious to take a look too.

The Pierre Auger Observatory in Argentina is still in the final stages of construction, but 1,300 of its 1,600 water Čerenkov detectors are already installed, as are 24 fluorescence-detecting telescopes. The array — covering 300 square kilometres of the *Pampa Amarilla* (Yellow Prairie), east of the Andes — is designed to have a dual sensitivity to cosmic rays. The Čerenkov detectors pick up particles reaching the ground from a cosmic-ray shower, revealing their energy and trajectory; the telescopes expose the development of a shower by detecting the fluorescence induced in atmospheric nitrogen.

The images here show 'Event 1234800', currently the 'most viewed' of all of the available data: captured in March 2005 across 14 detectors in the array, it has the highest energy of all events in the sample, 37.4 EeV (exaelectronvolts, 10^{18} eV). On the left is the close-up view of the triggered detectors, on the right the position of the shower in the array. (The scale is defined in terms of a 'vertical equivalent muon' in a detector.)

Many more events are already available for scrutiny — but the publicly available data will only ever amount to about 1% of the data taken at the observatory. Already the 370-strong collaboration, from 17 countries, have collected sufficient information to weigh in on a major controversy of cosmic-ray physics, that of the 'GZK cutoff'.

The interaction of protons (thought to be the main cosmic-ray particles) with the cosmic microwave background implies that there is a maximum energy for cosmic rays, at the level of 6×10^{19} eV. This is the Greisen–Zatsepin–Kuzmin (GZK) cutoff. However, particle-detection data taken by the AGASA experiment in Japan apparently included cosmic rays with energies that were factors of hundreds higher than the cutoff value. In contrast, the HiRES experiment in the USA, using the fluorescing-nitrogen signature of cosmic rays, saw no such ultra-high-energy excess.

The Pierre Auger Observatory has the benefit of both detection techniques and the collaboration has now confirmed — at the 30th International Cosmic Ray Conference held last month in Mérida, Mexico (www.icrc2007.unam.mx) — that it does not see an AGASA-like excess above the GZK cutoff.

With data-taking set to continue over the next decade, and the planned addition of a matching northern-hemisphere observatory in Colorado, USA, the Auger project may find an explanation for the generation and acceleration of cosmic rays. Watch the data accumulate at www.auger.org.

Alison Wright