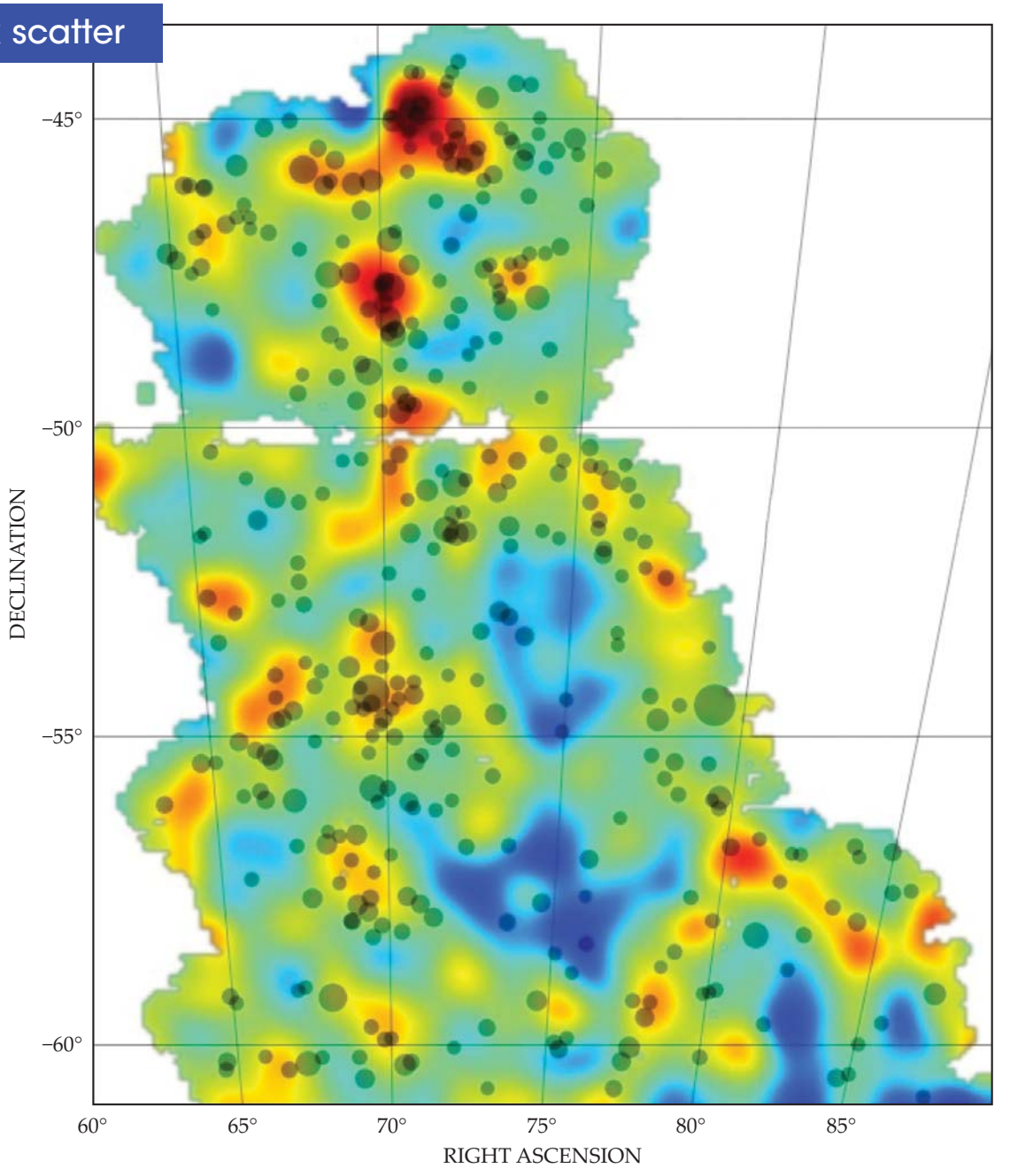

Wide-field map of dark matter

February saw the end of the second summer of operation by the Dark Energy Survey (DES) collaboration at the Victor M. Blanco Telescope in the Chilean Andes. Armed with a custom, state-of-the-art 570-megapixel camera, the collaboration is working to chart the 14-billion-year history of cosmic evolution. Over its five-year run, the survey will map more than 300 million galaxies in one-eighth of the night sky and will document an expected 3000 supernovae. Those data will provide key insights into the mysterious dark energy thought to be driving the universe's accelerating expansion. (See the article by Josh Frieman, PHYSICS TODAY, April 2014, page 28.)

One of the survey's measurement tools is weak gravitational lensing: Light coming to us from distant galaxies gets slightly deflected by the gravitational field of massive objects along the way, so the galaxies appear distorted. (See the article by Leon Koopmans and Roger Blandford, PHYSICS TODAY, June 2004, page 45.) From those distortions one can reconstruct the distribution of the foreground mass—most of which is otherwise-unobservable dark matter—and discern how dark energy influenced large-scale structures.

At the April 2015 meeting of the American Physical Society, DES team members Chihway Chang and Bhuvnesh Jain presented this detailed two-dimensional map (in celestial coordinates) of dark matter. Red areas are the most dense; blue, the least. Spanning 139 square degrees—less than 3% of the survey's ultimate coverage—the map is based on views of 2 million galaxies seen in four months of test observations as the experiment was being set up. The overlaid circles represent foreground galaxy clusters visible in the data. The cluster positions correlate well with the clumpy dark-matter distribution, as theories predict. Moreover, the team found that systematic errors in the data should fall within the measurement uncertainties. (V. Vikram et al., http://arxiv.org/abs/1504.03002.)

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