

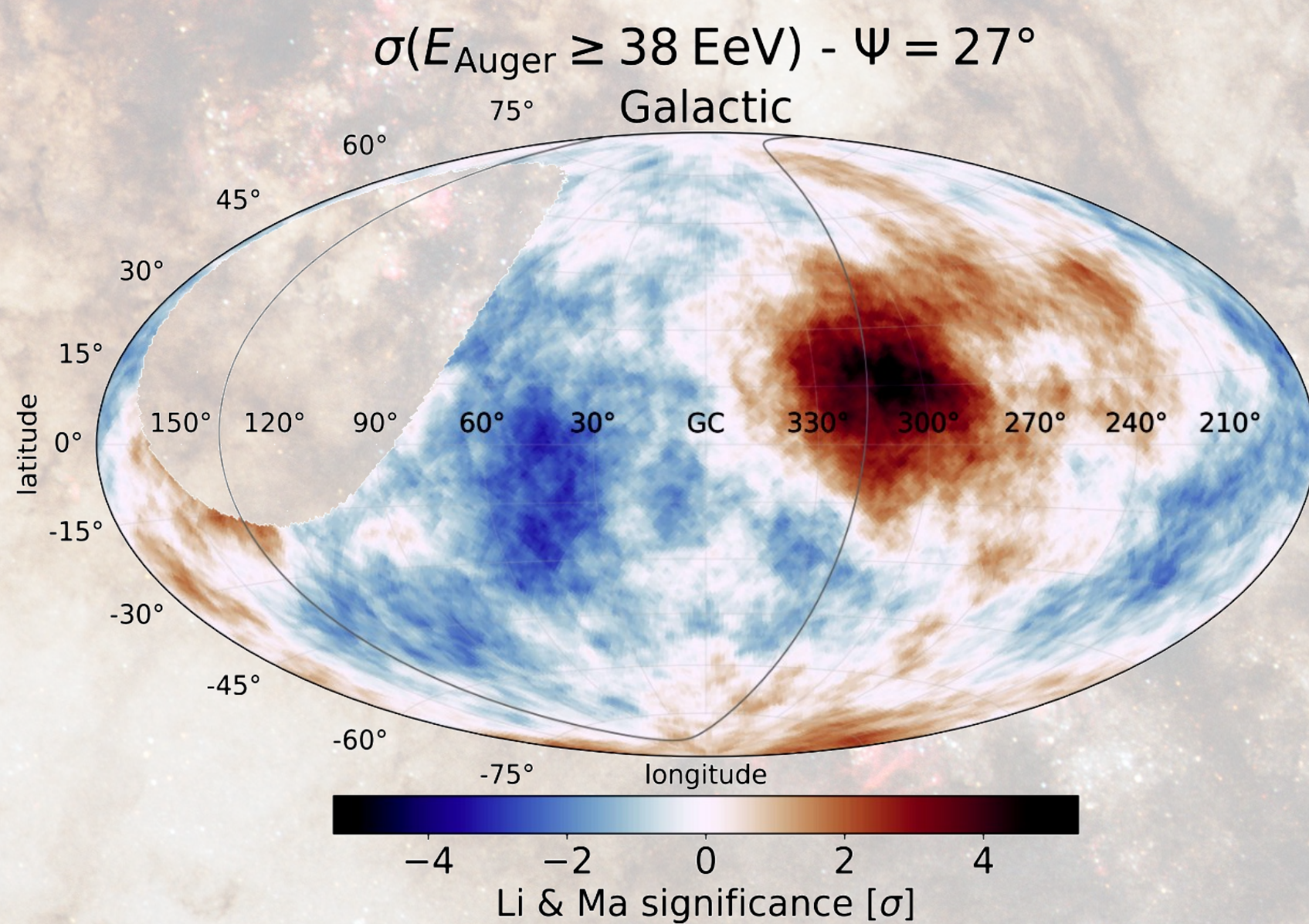
# 20 years of Arrival Direction Studies at the Pierre Auger Observatory

Max Stadelmaier <sup>a,b,c</sup>, for the *Pierre Auger Collaboration*

- a *Università degli Studi di Milano UNIMI, Milano, Italy*
- b *Istituto Nazionale di Fisica Nucleare INFN, Milano, Italy*
- c *Karlsruhe Institut für Technologie KIT, Karlsruhe, Germany*

## PIERRE AUGER OBSERVATORY

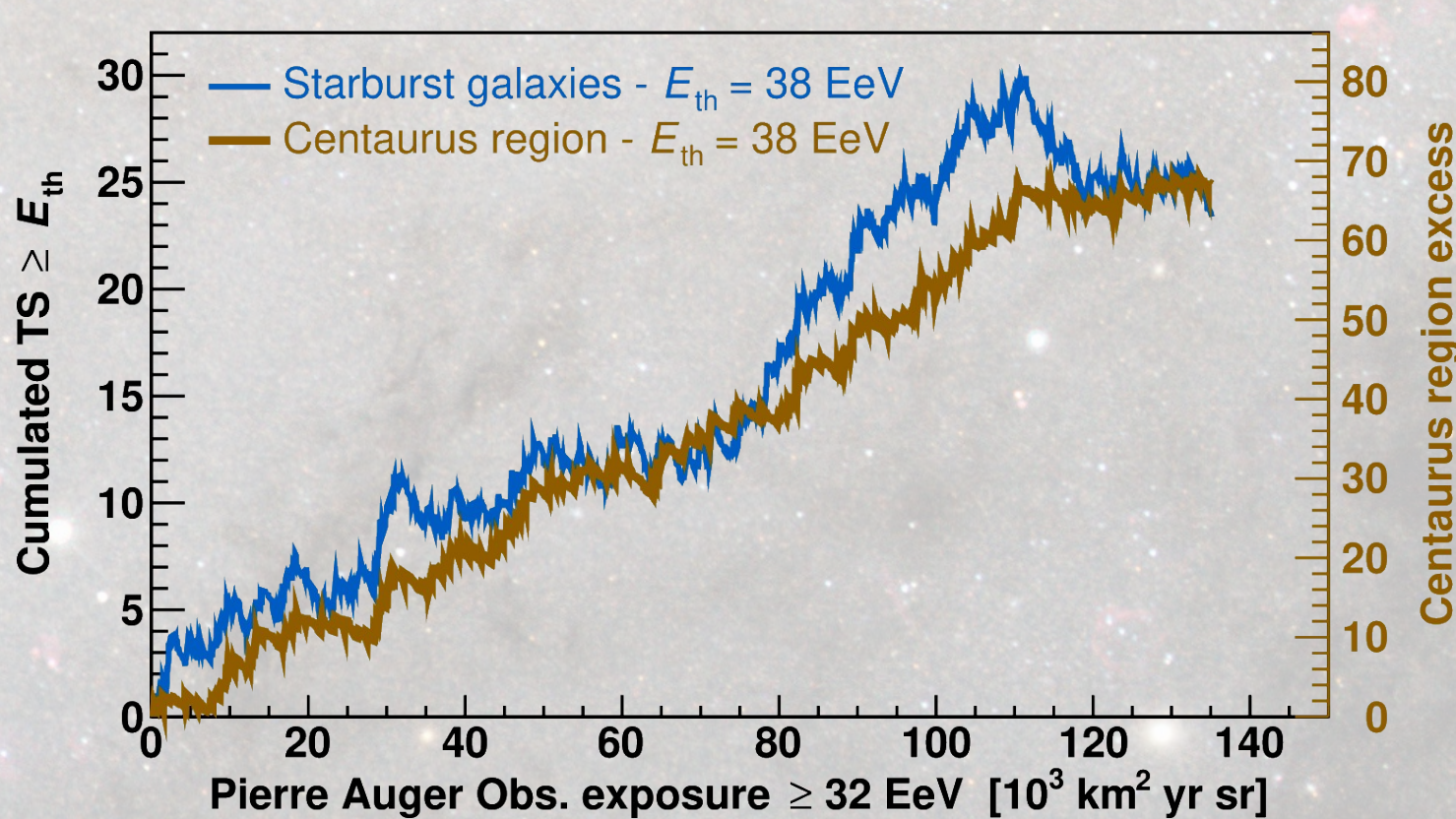
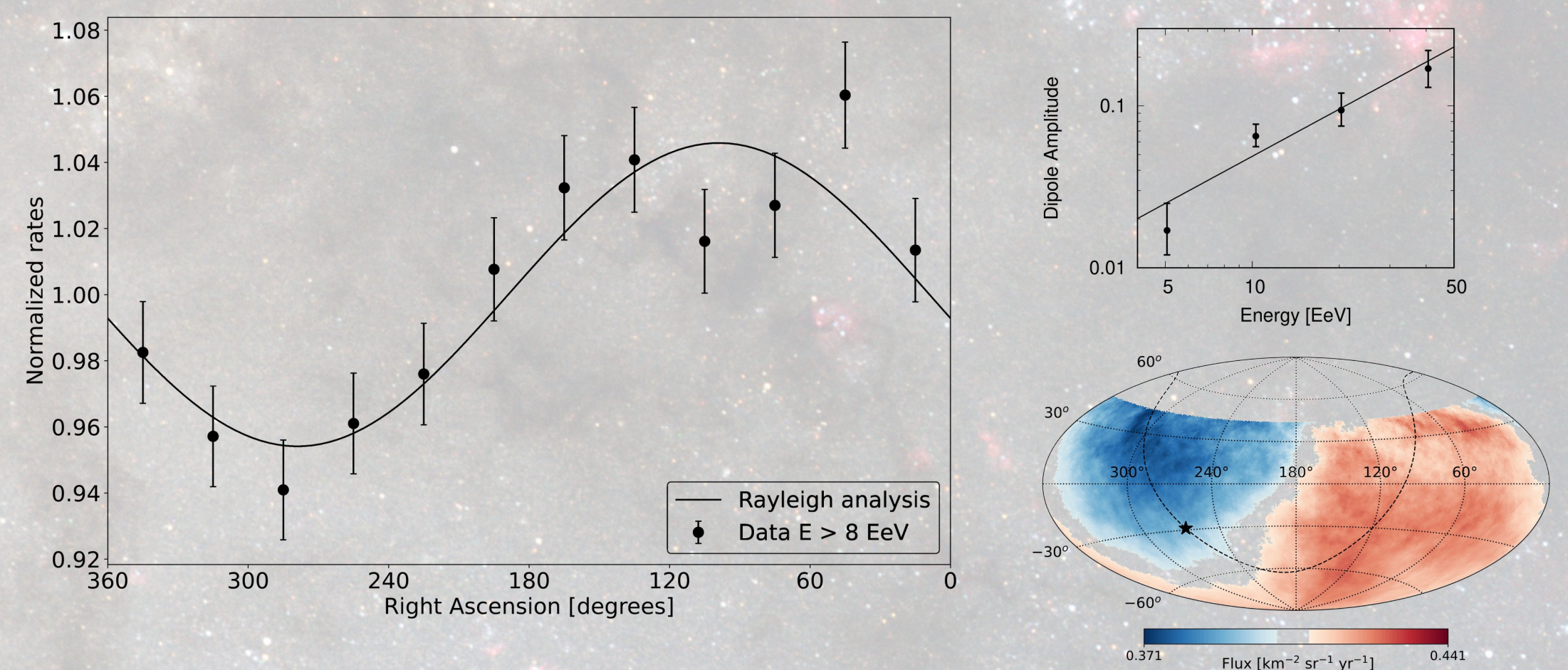
The Pierre Auger Observatory is the largest detector for ultrahigh-energy astroparticles in the world. Located in Argentina, it observes cosmic rays from approximately 80% of the sky, including the Galactic Center. The Observatory is sensitive to cosmic rays at energies of approximately 10 PeV up to the highest energies, exceeding 100 EeV, and has made significant discoveries in cosmic-ray research. While searches for localized, intermediate-scale, large-scale excesses, and mass-dependent excesses are ongoing, we present an overview of the most important results.



Small and intermediate scale searches have been performed in particular for cosmic rays above a primary energy of 32 EeV. While a single source (or source class) could not be identified so far, there exists an interesting excess of ultrahigh-energy cosmic rays, possibly entering the Galaxy from a direction close to Centaurus A.

The map on the left shows the Li-Ma significance of cosmic rays above 38 EeV within a radius of 27° for each point in the sky in galactic coordinates.

The discovery of a large-scale dipole anisotropy for cosmic rays above an energy of 8 EeV is strong evidence for the extragalactic origin of ultrahigh-energy cosmic rays. Figures on the right show the rate of cosmic rays as a function of right ascension, as well as the evolution of the dipole amplitude with primary energy, and the cosmic ray arrival direction in equatorial coordinates using 45° top-hat smoothing.



Both the excess of cosmic rays from the Centaurus region, as well as the coincidence signal with starburst galaxies have been steadily growing over time. It is expected that within a few years, either by accumulating enough statistics, or by employing novel analysis techniques, it would be possible to confirm these source scenarios with data from the Pierre Auger Observatory.

The Pierre Auger Collaboration has reported on numerous analysis regarding the arrival directions of ultrahigh-energy cosmic rays in the past. Some highlights are linked on the right-hand side! Try it out!

