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Multimessenger astrophysics at the Pierre Auger Observatory

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The complementary information carried by photons, gravitational waves, neutrinos and cosmic rays about individual cosmic sources and source populations provides a very powerful tool for studying the properties of the Universe. In the extreme energy regime, above 10^{17} eV, the Pierre Auger Observatory plays a central role in multimessenger astronomy, thanks to its ability to distinguish extensive showers generated by ultra-high energy photons and neutrinos from those of hadronic origin. The search for diffuse fluxes or point-like sources of neutrinos and photons allows us to study different candidate sources and to set limits to the emission of these neutral messengers by mergers producing gravitational waves. Neutrinos and photons also allow us to test the existence of possible effects beyond the Standard Model of particles, such as the decay of super-heavy dark matter, or the violation of Lorentz invariance.
An overview of the multimessenger activities carried out by the Pierre Auger Collaboration is provided, and the improvements that can be achieved with the upgrade of the Pierre Auger Observatory, AugerPrime, are discussed.

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