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The multi-messenger approach for current and future transient searches at very high energies

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The very high energy sky comprises many astrophysical sources originating from explosive or flaring events on different timescales, from fraction of seconds to years. These transient sources are largely observed and monitored in different bands of the electromagnetic spectrum, including very high energy (VHE, $E > 100$ GeV) gamma rays. Furthermore, transient sources are associated with systems of compact objects like black holes and neutron stars. Other non-photonic messengers, like gravitational waves and neutrinos, are expected to be produced in these extreme environments. Therefore the detailed characterization of the sources and environments of transient events should benefit from a multi-messenger approach for such searches.
In this context, Cherenkov telescopes like MAGIC face many challenges in the observation of transient sources at VHE, stemming in particular from their low duty cycle and limited field of view. Nonetheless, the planning of targeted follow-up strategies proved to be successful in the observation of transients. In this contribution, a particular highlight will be given to the synergies between MAGIC and facilities like LIGO/Virgo and IceCube, providing alerts on GW and neutrino events respectively. Such synergies are the key to many outstanding results, as demonstrated by the detection of the flaring blazar TXS 0506+06 in coincidence with a high energy neutrino and the first time detection of a Gamma-Ray Burst at VHE by MAGIC, GRB 190114C.
Finally, the future CTA experiment will open a new window in transient searches, thanks to its improved sensitivity, especially for short timescales.

Summary

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