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Explanation for the late-time radio flares in tidal disruption event

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Close encounters between stars and black hole result in the tidal disruption of the stellar due to the huge tidal force exerted on it, an accident known as tidal disruption events (TDEs). Recently, a few tidal disruption events have shown late-time (years after discovery) radio flares that last hundreds of days with flux densities ranging from 1 to 100 mJy, such as ASASSN-15oi, AT2018hyz. Here we propose a scenario that the late-time radio flares may originate from the interaction of the TDE outflow with circumnuclear dense gas clouds (torus). Collision of the outflow with the torus leads to the formation of the bow shock, which accelerates the electrons, amplifies the magnetic field, and produces a late-time radio flare after TDE. We calculate the associated radio signature and compare them with the observations. We find a general consistency between the observations and predictions with reasonable parameters value. Determined by the distance of the torus and the velocity of the outflow, the late-time radio flares occur hundreds of days after TDE and they can peak at 10^{39} erg/s, which is comparable to the observation. And the rise time is about hundreds of days which depends on the radius of the torus and the velocity of the outflow. Observations will play a key role in unveiling the nature of the late-time radio flare and a systematic study of a much larger sample would help understand the process responsible for it.

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