Origin of VPOS dwarf galaxies from tidal tails of the recent M31 merger

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A significant part of the Milky Way (MW) dwarf galaxies orbit within a Vast POlar Structure (VPOS), which is perpendicular to the Galactic disc and whose origin has not yet been identified. It includes the Large Magellanic Cloud (LMC) and its six dynamically associated dwarf galaxies. Andromeda Galaxy (M31) experienced a major merger two to three billion years ago, and its accurate modelling predicts that an associated tidal tail is pointing towards the Galaxy. We tested a possible association between M31 tidal tail particles and MW dwarf galaxies, focusing first on the LMC and its associated dwarfs since they are less affected by ram pressure. We traced back these dwarf galaxy orbits by one billion years and calculated their association with the tidal tail particles in the 6D phase space, based on their proper motion from *Gaia* DR3. We find that for low-mass MW models (total mass less than 5 $\times 10^{11} M_{\odot}$), the separation in the 6D space can be less than 1σ for most of the M31 modelling, albeit with a significant degree of freedom due to the still unknown proper motion of M31. We further find that six more dwarfs could also be associated with the same M31 tidal tail if their motions had been radially slowed, as expected from the ram pressure exerted by the MW corona. Another group of VPOS dwarfs that seem to infall from a different direction may be associated with a tidal tail originating from the first passage of the merger. If the dwarfs indeed formed in the recent tidal tail, we would be able to observe that signature in their star formation history, especially the difference in the star formation peak between the dwarfs of different tidal tails. ELT's high-resolution spectrograph ANDES would be able to resolve the star formation history of these dwarfs to a sufficient time resolution. Furthermore, SKA's L-band observation might be able to directly detect the gas component of the tidal tails.

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