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## Magnetic vector charges in the mystery of a circular current's pair of distinct Cartesian elemental magnetic dipoles

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A circular electric current, perpendicularly bisected by a field plane, was modelled as a continuum of pairs of distinct Cartesian component elemental magnetic vector charges normal and parallel to the field plane. The Cartesian elemental magnetic vector charges normal to the field plane pair up into Cartesian elemental magnetic dipoles with intra-dipolar displacements parallel to the plane. These dipoles generate the overall magnetic vector potential at the field point. The Cartesian elemental magnetic vector charge components parallel to the field plane form Cartesian elemental magnetic dipoles (with intra-dipolar displacements perpendicular to the field plane) which individually and collectively contribute nothing to the overall magnetic vector potential. Each continuum of these two sets of Cartesian elemental magnetic dipoles independently yields the traditionally renowned “magnetic dipolar moment of a circular current”. However, together their two distinct magnetic fields, as well as their two distinct magnetic torques, constitute the circular current’s overall magnetic field and the total magnetic torque respectively. These results reconcile only if the magnetic dipolar moments of both sets are endorsed, that is a circular current of any spatial size is a continuum of pairs of distinct Cartesian elemental magnetic dipoles and that consequently its overall magnetic dipolar moment is numerically twice the traditional value. In addition the customary ad hoc definition of the magnetic dipole moment of a current loop is deceptively erroneous, thus prompting a review of many relations involving it. These include the magnetic torque and magnetic field generated by it, and the classical magneto-mechanical ratio.

**Level (Hons, MSc, &nbsp; PhD, other)?**

other

**Consider for a student &nbsp; award (Yes / No)?**

no

**Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?**

yes

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