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Defects in the traditional analogy between the dipolar structure of a circular current and a simple electric dipole's

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Abstract content
   (Max 300 words)

It is shown that when a circular current is resolved into merged distributions of distinct Cartesian x and y component line current elements, each distribution is a complete magnetic dipole that selectively creates like Cartesian components of the magnetic torque and azimuthal magnetic vector potential, plus only the magnetic field's other Cartesian components. All these are expressible in terms of a distribution's own magnetic dipolar moment, which is traditionally attributed to the whole circular current. In contrast a simple electric dipole aligned on the z-axis, creates its electric torque x and y components, its full cylindrically symmetric electric field and the electric scalar potential, all expressible in terms of the sole electric dipolar moment. Each magnetic or electric Cartesian torque component is expressible as a cross product of a distribution's dipolar moment and one Cartesian field component parallel to an exclusive Cartesian plane perpendicularly bisecting the mutually parallel intra-dipolar displacements, while the distribution's corresponding potential vanishes in that plane. Under such special conditions, tradition compares one surviving Cartesian component of the magnetic torque or of the magnetic vector potential to respectively the electric dipole's combined x and y torque components or the whole scalar potential. Seemingly from this and the equality of the magnetic dipolar moments of the two component distributions of the cylindrically symmetric circular current, tradition incorrectly defines either of these magnetic dipolar moments as that of the entire circular current.

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Primary author: Dr CHIRWA, Max (Walter Sisulu University)

Presenter: Dr CHIRWA, Max (Walter Sisulu University)

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