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Third Elementary Dipole Moment: Toroidal VINCENT CORDREY, AMANUEL ESHETE, WALERIAN MAJEWSKI, Northern Virginia Community College, Annandale, VA — In this paper we study the generally unknown characteristics of toroids, magnets without magnetic poles. Toroids have never seemed interesting enough to be studied for their physical features in labs due to the fact that they have no magnetic fields on the outside, but rather a very strong magnetic field trapped inside. Toroidal solenoids or magnets (rings magnetized circumferentially) interact with the external magnetic field only through its curl, which can be created either by an electric current, or by a time-dependent electric flux. We confirmed a theoretical prediction, that a toroid would not interact with the curl-less magnetic field of a current-carrying wire running outside of the torus's hole. We used our toroids as magnetic curlmeters, measuring the torque on the toroid, when the current-carrying wire runs through the toroid. From this torque we found the toroidal dipole moment. We are experimenting on detecting the escape of the inner magnetic field of the toroid outside of it, when magnetic toroid rotates or when electric toroid is driven by AC voltage. We also will discuss toroidal (or anapole) moments of fundamental particles, nuclei and atoms, and toroids' applications in metamaterials.

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