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First Determination of the Shear Forces Inside the Proton LATIFA ELOUADRHIRI, VOLKER BURKERT, Jefferson Lab, FRANCOIS XAVIER GIROD, University of Connecticut — Protons and neutrons, generally referred to as nucleons, are the fundamental building blocks of nuclei and make up nearly 100% of the mass of normal matter in the universe. They are composed of elementary objects, quarks and gluons. The latter are the carrier of the strong force that governs the dynamics binding quarks and gluons together. It is well established that quarks do not exist in isolation but only in the confines of nucleons and mesons (hadrons) of finite size. The forces between quarks and the angular momentum distributions are largely unknown. The mechanical properties of the proton, including pressure, forces and mechanical size are encoded in the proton's matrix element of the energy-momentum tensor and are expressed in scalar gravitational form factors (GFFs). Recent theoretical development showed that the GFFs may be probed in deeply virtual Compton scattering (DVCS). In this process two photons couple to the proton and mimic the graviton-proton interaction, and hence probe its mechanical properties. Here we present the first extraction of shear forces and their spatial distribution inside the proton and compare the results with model prediction.

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