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Diagnostics is a very important issue in plasma. We developed a novel plasma diagnostics method using a THz (terahertz) wave pulse, where the THz pulse is generated by focusing an intense laser pulse in gas. In this process, the focused laser pulse ionizes the gas atoms and the strong interaction between the laser pulse and the plasma can generate an intense THz pulse. To utilize the laser-produced THz pulse for plasma diagnostics, we developed a small-scale ICP (inductively-coupled plasma) source, which consists of an 8-turn coil antenna and a quartz tube with a length of 12 cm and a diameter of 2.5 cm. An RF (radio-frequency) source with a frequency of 13.56 MHz is used to produce a plasma in the ICP source. Argon or helium gas is injected into the quartz tube that is pumped by a dry pump. The ICP source and RF system were adjusted to produce plasma densities on the order of 10^{13} cm^{-3} and the THz pulse was sent through the plasma. The transmitted THz pulse is analyzed and it turns out that it can give the plasma density information successfully. In this talk, details of the research are presented.