RF measurement by Rydberg atoms quantum sensor

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This study is devoted to the development of a recently proposed new technique for measuring electric fields based on the effect of the field on transitions in a Rydberg atom. This technique not only enables absolute measurements without probe calibration, but also introduces minimal distortions into the measured field, as it does not require excitation of conduction electron currents, and the probes used are made of a dielectric. The principle of field measurement in atom-based detectors is that an electromagnetic field causes splitting of the high-lying Rydberg state (the Autler-Townes splitting), with the magnitude of this splitting being directly proportional to the field amplitude. This splitting can be recorded in the electromagnetically induced transparency (EIT) spectrum. Frequency selectivity of the detector is achieved by selecting the Rydberg level number. Rydberg detectors can measure field amplitudes from a few mV/m in a frequency range from tens of MHz to several THz, such as dilute plasma field. The research is supported by the Russian Science Foundation (project No. 25-22-00897).