RESONANT AMPLIFICATION OF THE MAGNETIC FIELD BY DIELECTRIC RING MAGNETIC DIPOLE

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MMagnetic fields in low-pressure plasma have a strong influence on the formation and dynamics of dust structures. In dusty plasma, they are created either by permanent magnets or by coils with current. Changing the magnitude, frequency and direction of the magnetic field is possible only with the help of the conduction current in the galvanic circuit. Another method of creating magnetic fields in the dust plasma region can be the use of a dielectric ring magnetic covering a discharge tube with dust plasma. We have previously shown that when a plane electromagnetic wave resonantly excites magnetic modes in dielectric objects, a huge increase in magnetic field induction occurs. However, in simple dielectric objects, the electromagnetic wave initiates many different types of resonances and calculations of resonant frequencies and scattering fields in this case become a difficult task. Therefore, the task of creating a dielectric magnetic dipole with a basic resonant frequency, which can be calculated from the concepts of capacitance and self-inductance, and scattering fields from the Bio-Savard-Laplace law, becomes important. However, the question arises of the applicability of the concept of self-inductance for a dielectric circuit and the Bio-Savard-Laplace law similarly to a metal ring. The objective of this study was to study the distribution of magnetic fields of the dielectric magnetic dipole in the form of the flat dielectric ring in the microwave region and compare it with the results of theoretical and computer calculations. The measured resonance spectra for an annular dielectric circuit and their comparison with calculations have shown that the main contribution to the scattering fields of the electromagnetic wave by the flat ring in the region of the main resonant frequency is made by the magnetic dipole. The measured magnetic field distributions are consistent with computer simulation. Based on the results of measurements and calculations, it can be concluded that the flat dielectric ring is the magnetic dipole with displacement currents, magnetic fields can be calculated based on the Bio-Savard-Laplace law, and the dielectric ring can be used as the magnetic dipole for various studies and applications. This research was supported by The Ministry of Science and Higher Education of the Russian Federation (Agreement with Joint Institute for High Temperatures RAS No. 075-15-2020-785)