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ANOMALIES IN RADIATION-COLLISIONAL KINETICS OF RYDBERG ATOMS INDUCED BY THE EFFECTS OF DYNAMICAL CHAOS AND THE DOUBLE STARK RESONANCE

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Radiative and collisional constants of excited atoms contain the matrix elements of the dipole transitions and when they are blocked one can expect occurring a number of interesting phenomena in radiation-collisional kinetics. In recent astrophysical studies of IR emission spectra it was revealed a gap in the radiation emitted by Rydberg atoms (RA) with values of the principal quantum number of $n \approx 10$ [1]. Under the presence of external electric fields a rearrangement of RA emission spectra is possible to associate with manifestations of the Stark effect. The threshold for electric field ionization of RA is $E \approx 3 \bullet 10^4$ V/cm for states with $n > 10$. This means that the emission of RA with $n \geq 10$ is effectively blocked for such fields. In the region of lower electric field intensities the double Stark resonance (or Förster resonance) becomes a key player. It turns out [2] that the static magnetic or electric fields may strongly affect the radiative constants of optical transitions in the vicinity of the Föster resonance resulting, for instance, in an order of magnitude reduction of some lines intensity.

In the atmospheres of celestial objects lifetimes of comparatively long-lived RA states and intensities of corresponding radiative transitions can be associated with the effects of dynamic chaos via collisional ionization. The Föster resonance allows to manipulate the random walk of RE in the manifold of quantum levels [2] having redistributed, thus, the excitation energy of RA with occurrence of accompanying anomalies in the IK spectra.

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