

Kinetic description of the far regions of the 3d streamer formed by coupling of the external maxwellian plasma flows with magnetic dipole and toroid at active region

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We consider in terms of the Vlasov/Maxwell kinetic approach a classical problem of inductive generation by the solar wind flow of the 3D solar streamer/tail structures originating by magnetic flux sources at the Sun magnetoactive regions. The input flow is a hot collisionless plasma with maxwellian distribution function. We separated magnetic field interacting particles on trapped and untrapped (“fly by”) particles. Trapped particles partly are parameterized by magnetic flux source configuration. The source is approximated by densities of magnetic dipole and magnetic toroid currents distributed on the characteristic scale and characterized by ratio of their integral currents. “Fly by” particles motion we treat via perturbations resulting a linear analytical approach to the flowing plasma. Plasma appeared as a result in the problem like resistive and diamagnetic media. Non local resistive currents are characterized by anomalous skin scale and diamagnetic currents by magnetic Debye scale. Ratio of the diamagnetic currents to the resistive currents is a Quality of the streamer magnetosphere. We get integral representation of a selfconsistent global 3D magnetic configuration which is defined via two different kinds of cylindrical harmonics. For maxwellian plasma we get a low Quality regime when 3D structure is with resistive currents and only parameter is a specific collisionless magnetic Reynolds number. A dipole generates 3D “two wire” multi magnetic ropes current configuration (cylindrical dipole harmonics) which is observed in the far down tail regions of the streamer. Toroid generates classical 3D “theta type” current configuration (cylindrical toroid harmonics) with spatially modulated neutral sheet inside and it is observed closer the sources. Separation of the two configurations in the streamer we associate with difference in internal structure, mutual perpendicular orientation of magnetic dipole and toroid and ratio of their currents. Toroid has spatially more complicated then dipole current system and its generated current is defined by higher order derivatives of the magnetic streamer Green characteristic function. The function has power law decay in asymptotic with fine spatial modulations with the special scale depending from anomalous skin scale and distance to the magnetic flux source. We have faster decay of the “theta type configuration” in comparison with a “two wire configuration” downward to the sources at the Sun magnetoactive region. Our kinetic approach via invention of a new plasma spatial dis-

persion parameters and new dimensionless values Quality and ratio of the currents in the source give us possibility to get analytically a selfconsistent 3D fine structure of magnetic configuration at far regions of the coronal streamer.