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JPRS 80259

ELECTRICITY AND MAGNETISM

8 MAR 82

STRONG SCATTERING OF PARTICLES IN RANDOMLY INHOMOGENEOUS MAGNETIC FIELD

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 81, No 5(11), Nov 81 (manuscript received 7 May 81) pp 1723-1730

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[Abstract] A kinetic equation is derived that describes propagation of charged particles in an electromagnetic field with random inhomogeneities in intense scattering. The formulated problem is analogous to the theory of strong scattering of electromagnetic waves, and to the problem of hydrodynamic turbulence, where there is no small parameter. Solution of the problem is based on Orszag's approach [see S. A. Orszag, JOURNAL OF FLUID MECHANICS, Vol 41, 1970, p 363], which yields the Kolmogorov spectrum in hydrodynamic turbulence theory. At the weak scattering limit, the derived equation is automatically transformed to previously found results. The proposed method improves on Orszag's scheme in the fact that an equation is derived for the memory time of the system τ, rather than merely assigning this parameter. The proposed kinetic equation is valid even when the particle scattering angle on the correlation length of the magnetic field is not small. An examination is made of the diffusion approximation with consideration of particle acceleration by a stochastic electric field. References 12: 6 Russian, 6 Western.
[78-6610]

FLUID DYNAMICS

UDC 541.124/128

NONEQUILIBRIUM VIBRATIONAL MOLECULAR EXCITATION BEHIND SHOCK WAVE FRONT IN GASES

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian
No 5(129), Sep-Oct 81 (manuscript received 25 Jun 80) pp 49-54

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[Abstract] Previous research has shown that when a shock wave propagates through a light gas doped slightly with a heavy gas, the length of translational relaxation of the heavy molecules is approximately m_G/m_L times longer than for the light molecules (where m_G and m_L are the masses of the heavy and light components). This is because a large number of collisions is needed to slow down a heavy particle. In this paper, a qualitative analysis is made of phenomena that take place in deceleration of a molecule made up of atoms with masses m_H and m_F in a medium of particles of mass m_L ($m_H \gg m_F \gtrsim m_L$). The fraction of vibrational energy transmitted to the molecule as it is decelerated in the light gas is calculated, and an examination is made of relaxation of the vibrational energy of molecules described by harmonic oscillators in the zone of deceleration in the light gas behind the shock wave front. It is shown that shock wave propagation in such a medium may be accompanied by a process of "nonequilibrium" excitation of the heavy gas molecules in which the vibrational temperature may rise to levels that exceed the gas temperature behind the shock wave front in contrast to the equilibrium case. An example of calculation of the vibrational energy in a shock wave in a mixture of helium with uranium hexafluoride is given. The possibility of experimental confirmation is discussed. Figures 2, references 7: 5 Russian, 2 Western.
[70-6610]