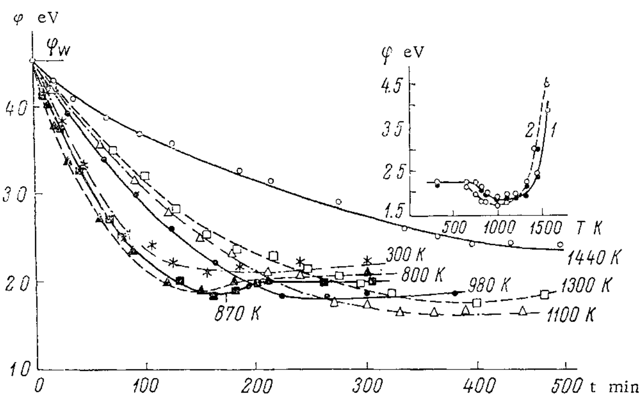
Volume 4, Number 9, March 1963

Data Relating to the Production of Lead Sulfide Single Crystals, I S Aver'yanov, N S Baryshev V G Baru, and G I Yudina, pp 1720–1724

Lead sulfide single crystals of n- and p type with carrier con centrations up to 10^{17} cm^{-3} were grown by the Bridgman Stockbarber method We have investigated the process of PbS crystal growth from the melt with due regard to interaction between the solid and vapor phases The reasons underlying the creation of p n junctions during the growth of lead sulfide single crystals are discussed We have examined the possibility of controlling the characteristics of PbS single crystals by treatment and zone melting in sulfur vapor We have evaluated numerically the accuracy to which the operating conditions must be stabilized at various annealing temperatures in order to obtain specimens with carrier concentrations of the order of 5×10^{16} cm^{-3} We have obtained a general formula for the equilibrium sulfur pressure which takes into account the existence of donor and acceptor impurities

Work Function of Thin Layers of Barium Oxide Deposited on Hot Tungsten, T S Kirsanova, A R Shul'man, and A V Dement'eva, pp 1918–1919



Dependence of the work function of the BaO - W system on the duration of deposition for various substrate temperatures In the inset curve 1 shows dependence of equilibrium work function on substrate temperature, and curve 2 gives dependence of quasi-equilibrium work function on temperature of subsequent treatment Different rates of deposition are denoted by different points

It has been shown that the heating of barium oxide layers de posited onto cold tungsten and molybdenum foils at comparatively low temperatures (1000–1200 K) increases the thermionic activity: The work function of the BaO-W system is reduced, compared with its value immediately after deposition The present paper describes the results of experiments on changes in the work function of BaO-W systems prepared by deposition of barium oxide onto tungsten foil kept at various temperatures

Changes in the Surface Potential of Lead Sulfide Layers on Illumination, R Ya Berlaga and T T Bykova, pp 1929–1930

Changes in the surface potential of polycrystalline layers of lead sulfide on illumination were determined by measuring the changes in the contact potential difference between PbS and a standard electrode using modulated illumination

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Determination of the Physical Properties of the Cyanogen Envelopes of Halley's Comet, 1910—II, D O Moknach, pp 1–3

Splitting of Nonevolutionary Magnetohydrodynamic Shock Waves, V V Gogosov, pp 10–12

In this paper a method is proposed allowing one to determine into which combination of evolutionary discontinuities and progressing expansion waves a magnetohydrodynamic shock wave will split (decompose) No assumptions are imposed on the parameters of the medium or intensity of the shock

Evolution discontinuities are discontinuous solutions of nonlinear differential equations which depend continuously on the initial and boundary conditions Thus, gasdynamic or magnetohydrodynamic shock waves will be evolutionary if small changes in the gasdynamic or magnetohydrodynamic quantities result in small changes in the solution The first idea of evolutionarity was expressed in references noted in connection with the study of discontinuities in ordinary gas dynamics

General Theory of Steady Motion in Relativistic Hydrodynamics, I S Shikin, pp 13–14

We shall investigate the steady adiabatic motion of an ideal gas in relativistic hydrodynamics (within the framework of the special theory of relativity) We shall consider the entropy in general to differ from one streamline to another In this paper, it is shown that each such motion reduces to the nonrelativistic motion of some gas The potential plane parallel motion of an ultrarelativistic gas was shown in another paper

Interpretation of Nonstationary Relativistic Hydrodynamics in Minkowski Space, I S Shikin, pp 15–17

We will consider the adiabatic motion of a perfect nonviscous gas in relativistic hydrodynamics (without taking gravitational fields into account) As was shown elsewhere, every steady motion in relativistic hydrodynamics can be treated as nonrelativistic, steady motion of a corresponding gas It is shown here that nonsteady motion in relativistic hydrodynamics can be treated, in the same quantities in four dimensional space time, as nonrelativistic steady motion, assuming that the constant in the Bernoulli equation is 0

Structure of Relativistic Nonlinear Waves in a Plasma, V N Tsytovich, pp 31–33

When a relativistic beam of charged particles passes through a plasma, waves which are propagated with a speed close to that of light are excited in the plasma The linear approximation for the treatment of waves in the system can serve only to estimate the time of development of the nonlinear motion in terms of the logarithmic increment of the oscillations Nonrelativistic nonlinear waves in a plasma have been considered in other papers Here we wish to call attention to a number of interesting properties of relativistic nonlinear waves, and also to use the example of two mutually penetrating identical plasmas to illustrate the solution of a nonlinear problem of the energy loss of a beam in a plasma

In writing the system of equations with which we begin we shall assume that: 1) the use of the hydrodynamical approximation of zero temperatures to describe the plasma and the beam; 2) the ions which initially compensate the space charges of the plasma and the beam are stationary; 3) the motion is one dimensional (depends on the time x_0 and the coordinate x)

Impact Compressibility of Liquid Nitrogen and Solid Carbon Dioxide, V N Zubarev and G S Telegin, pp 34–36

The experimental investigations of the compressibility of N_2 and CO_2 by static methods relate to the region of comparatively low pressures and densities Thus, for N_2 the greatest pressure (P = 15,000 atm) and densities (ρ = 1 1 g/cm^3) were achieved by Bridgman in the isothermal compression of nitrogen (T = 338 K) More detailed investigations of the equations of state for these substances were conducted at still lower pressures The aim of the present work was to reach pressures of hundreds of thousands of atmospheres and densities of $\sim$2-3 g/cm^3 in substances which form the bulk of explosion products obtained in the detonation of condensed explosives

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Theory of Gyroscope Follow-Up in the Presence of Random Interference, L Ya Roitenberg, pp 110–113

A gyroscope follow-up is a gyro with three degrees of freedom operating in accordance with the gyroscope stabilization principle The axis of the outside Cardan ring of the gyro is vertical and the axis of its case horizontal The outside Cardan ring should follow the useful input signal transmitted from without, from some actuating system The input signal consists of a useful signal plus interference, the latter being represented by a stationary random process whose correlation function is assumed to be known In the present article the optimum reproduction of the useful signal will be considered by means of a gyroscope follow-up system, the minimizing of the mean square error being taken as the optimization criterion

Influence of Elasticity in the Axis Bearing of the External Ring in a Cardan Suspension of the Nutation and Drift of a Gyroscope, S A Kharlamov, pp 114–117

Volume 7, Number 3, September 1962

Abrasive Wear and Cavitation, S P Kozyrev and K K Shal'-nev, pp 176–179

One quite frequently observes in the parts of hydraulic machinery subjected to abrasive wear, in addition to surfaces worn with uniform periodicity, local wear in the form of relatively deep grooves Localized wear is usually attributed to some kind of flow obstacles on the surface of the part (irregularities due to rough finishing of the part, blisters in the metal, beading, bolt holes, etc) or to the abrupt streamlines engendered by the shape of the part There is reason to believe that the cause of localized wear, besides abrasion, is cavitation of the cutting type, which arises in the vortex formation zone However, there are currently conflicting opinions concerning the contribution of cavitation to abrasive wear, which is the result of a lack of experimental research on this problem, although it is of considerable importance in the choice of metal for hydraulic machinery

Summary:

1) In the case of a circular cylinder immersed in a plane-parallel flow in a tube of rectangular cross section, where abrasive particles are carried along the flow in an amount corresponding to medium saturation, the following kinds of wear take place: groove (local) wear, encircling the cylinder on the oncoming side and involving frontal vortices; and periodic wear, associated with the vortical structure of the boundary layer In the zone of the rear vortices periodic wear is observed, but it does not reflect the vortical structure of the flow

2) With cavitation zones present in the flow there is an increase in the intensity of wear both in the cavitation zone and outside of it The increased wear in the cavitation zone is explained by the combined action of abrasion and cavitation The increased intensity of periodic abrasive wear is explained by an increase in flow turbulence in the presence of cavitation

3) Cavitation of the cylinder does not effect the intensity of the grooving type of wear due to abrasion Irregularities on the surface of the groove can cause local cavitation and cavitation erosion

4) Abrasive and cavitation wear have the property in common that in the case of disruptive flow around the model both kinds of wear, which are mutually reinforcing, are situated in the zone of cavitation behind the cylinder, in the zone of rear vortices The essential difference is that cavitation and cavitation erosion do not occur on a smooth, flat surface, whereas abrasive (periodic) wear does

5) The choice of suitable metal for hydraulic machinery operating under cavitation conditions in water containing any kind of accretion should be made on the basis of testing for the combined effect of cavitation and abrasion

Maximum Directivity of Antennas Consisting of Discrete Radiators, E I Krupitskii pp 257–259

The problem of increasing the directivity of antennas while limiting their dimensions has been studied frequently in the literature during the last 10 years, beginning with the paper by Oseen The basic results were obtained from a mathematical analysis of the problem in other papers The published studies demonstrated that, although in principle an antenna of limited dimensions may have an arbitrarily high coefficient of directivity, in practice we can realize only moderately" ultradirectional" antennas The latter fact applies equally to both continuous and discrete antennas In a number of the published papers results are cited for the practical realization of sι ch antennas One of the basic theoretical questions involved in the problem under study is the question of the uniqueness of its solution Here in the case of discrete antennas we are speaking of the uniqueness of the distribution of the radiated currents; this uniqueness assures a maximum antenna directivity in a given direction

The purpose of this paper is to give a rigorous proof of the theorem for the existence and uniqueness of the solution for the problem of designing an optimum discrete antenna; also, as a corollary of this theorem we present a rigorous derivation of the general design formulas For simplicity we limit our analysis to antennas consisting of a finite number of specified and identically polarized individual radiators, since these are of fundamental practical interest The arrangement of the individual radiators in space can be arbitrary but is also assumed specified

Volume 7, Number 4, October 1962

Mean-Density Method in the Calculation of the Motion of Charged Particles on an Electronic Computer, S P Lomnev, pp 303–305

Some authors believe that the method of direct integration of the dynamic equations in the many-body problem has no future The principal difficulties associated with this method are the large number of equations and the necessity for specifying the initial values However the development of computers has aroused hope that many problems will be solved by this method At the present, limitations in the memory capacity of machines prevents the solution of the necessary number of equations, and therefore the development of direct methods involves the derivation of methods for decreasing this number One of these methods was described elsewhere Here we propose and describe another method

Stability of a Plasma Cylinder in the Case of a Nonuniform Cross-Sectional Current Distribution, Yu V Vandakurov, pp 326–328

Volume 7, Number 5, November 1962

Problem of an Explosion on the Surface of a Liquid, A A Deribas and S I Pokhozhaev, pp 383–384

In this article, we consider approaches to the problem of the motion of a finite-depth liquid produced by an explosion on the surface The explosion is assumed to be strong, i e , its effect is determined by one parameter, and the acceleration of the liquid particles is much greater than the acceleration of gravity Since the shock-wave velocity in water exceeds by several orders the rate of expansion of the funnel produced, we may assume in our investigation of the motion of the liquid that the shock wave travels at an infinite speed, and that the compressibility of the liquid can be neglected

The relevant parameters for the phenomenon we are considering are the following: ρ, the density of the liquid; ρ_1, the density of the medium above the liquid ($\rho_1 \ll \rho_0$); λ, the adiabatic exponent for the medium above the liquid; Π, a parameter characterizing the action of the explosion on the motion of the liquid

Kinetic Equation for a Relativistic Gas in an Arbitrary Gravitational Field, N A Chernikov, pp 397–399

In this article, we derive the kinetic equation determining the behavior of a relativistic ideal gas in an arbitrary Einstein gravitational field This equation cannot be derived by the method usually employed to obtain the Boltzman equation in the nonrelativistic case 1 he very concept of the distribution function is usually based on the concept of time t, while in an arbitrary gravitational field the synchronization of time is impossible

A method was suggested elsewhere to remove this shoι t coming of the usual approach employed in the description of an ideal gas The method was further developed in other papers It permits one to find the kinetic equation of motion for a relativistic ideal gas in an arbitrary gravitational field

Radiative Correction for the Intensity of Cerenkov Radiation of Charged Particles, V N Tsytovich, pp 411–413

The classical theory of Cerenkov radiation developed by I E Tamm and I M Frank, and E Fermi, as we know, describes the macroscopic losses by charged particles in the first order in e^2 The quantum corrections, taking into account the recoil during the radiation in the same order of e^2, are usually small In the first-order approximation, these corrections have a relative order of ω/ϵ_p, where ω is the frequency of the radiated quantum and ϵ_p is the particle energy ($h = c = 1$) We consider here the radiative corrections to the energy losses, i e , we take into account terms of the next order in e^2 (more precisely, the terms e^4 and $e^4 \ln e^2$)

For the calculation, we will use the Green's function method, which allows us to find the energy losses from the poles of the analytic extension of the Green s function of the particle The calculations are considerably simplified if in all orders of e^2 we take into account only terms of the first order in ω/ϵ_p (more accurately, we neglect terms of the order ω/ϵ_p in comparison with unity)