($\rho(x)>0$; $-\infty<t\leqq t_0$). The coefficients are continuous and suitably differentiable in $x_1, \cdots, x_m$ for x in a bounded open domain D; they are allowed to become infinite in the neighborhood of the frontier $F(D)$ of D; $F(D)$ may be irregular. (E), (H) are transformed into an integral equation, whose kernel $K(x, z)$ is fundamental for our theory. When $K(x, z)$ is L_2 in a certain one of the variables, while $F(u)$ is self-adjoint, (E), (H) can be effectively studied by methods of spectral theory; when $K(x, z)$ is L_2 in (x, z), Fredholm's theory of integral equations is applicable even when $F(u)$ is not self-adjoint. In the first case it is said the problems are of type (S); in the second—of type (F). Explicit conditions on the coefficients in (E), (H) are found under which the problems are of types (S) or (F). The spectral theory then is developed, yielding various results on existence of solutions, their properties, conditions for their uniqueness, and so on. This work is related to the author's and T. Carleman's earlier works on elliptic partial differential equations. (Received July 8, 1944.)

227. H. S. Wall: *Note on the expansion of a power series into a continued fraction.*

This paper contains an algorithm for expanding a power series into a continued fraction which is based upon the fact that the process for constructing a sequence of orthogonal polynomials can be so arranged that it gives simultaneously a continued fraction expansion for a power series. (Received June 5, 1944.)

228. H. S. Wall: *The convergence of a positive definite J-fraction in the limit-circle case.*

Theorems 4.1, 4.2, 4.3 and 4.4 of the paper *Contributions to the analytic theory of continued fractions and infinite matrices* by E. D. Hellinger and H. S. Wall, Ann. of Math. vol. 44 (1943) pp. 103–127, are extended, with appropriate modifications in the series (4.7), (4.8) and in the polynomials (4.12), to general positive definite J-fractions. Thus, in the limit-circle case, a positive definite J-fraction must either converge over the whole plane to a meromorphic limit-function, or else diverge for every value of the variable. (Received July 13, 1944.)

Applied Mathematics

229. Nathaniel Coburn: *The Kármán-Tsien pressure-volume relation in the two-dimensional supersonic flow of compressible fluids.*

First, the applicability of the Kármán-Tsien idea in the supersonic range is discussed. Secondly, it is shown that when the Kármán-Tsien relation can be used, the characteristics form a Tschebyscheff net. Further, if the diagonal curves of these characteristics are drawn so as to correspond to equi-intervaled values of the arc length parameter along these characteristics, then these diagonal curves will be the families of equipotentials and stream lines. Analytically, this last result means that the determination of the stream lines depends upon two arbitrary functions of a real variable. The conditions satisfied by these functions are discussed in the case where the given data is of Dirichlet type (two known stream lines as in the jet problem). In particular, if one of the known stream lines coincides with the x-axis, it is shown that only one arbitrary function enters into the problem of determining the stream lines. (Received June 2, 1944.)

230. A. J. Coleman: *Phase space in Eddington's theory.*

The set of 4-way symmetric unitary matrices constitutes a 10-dimensional continuum which plays a large role, under the name *phase space*, in Sir Arthur Eddington's *Relativity theory of protons and electrons.* Eddington introduces a metric into phase space and asserts that it is important for his theory that the total volume of phase space be *finite*. If one denotes the transpose of A by A', then any point, P, may be written $P=ADA'$ where D is unitary and diagonal and A is unitary and satisfies $AA'=I$. By choosing the ten parameters upon which A and D depend as coordinates in phase space, it is shown in the present paper that the volume is *infinite*. (Received July 6, 1944.)

231. A. J. Coleman: *Red-shift in the sun.*

The observed shift of the lines of the sun's spectrum, including the Limb effect, is too complex to be explained by Einstein's classic discussion which makes no assumption about the nature of the source of light. In this paper a correction of the Coulomb force due to a point charge is derived by solving Maxwell's equations in a gravitational field. For the sun, the correction is of the same order of magnitude as Einstein's but depends on the orientation of the atom in such a way as to suggest an explanation of the Limb effect. The correct choice of quantum equations for an atom in a strong gravitational field being still in doubt, it has not yet been possible to compare the consequences of the above result with experiment. (Received July 6, 1944.)

232. Eric Reissner: *On the theory of bending of elastic plates.*

In this paper a system of differential equations of the sixth order is established for the linear problem of bending of thin plates. Results obtained by the application of these equations coincide with the results of the classical theory of thin plates, except for narrow edge zones. Three boundary conditions may now be satisfied while, as is well known, the classical theory leads to two boundary conditions only. The significance of the problem has recently been discussed by J. J. Stoker (Bull. Amer. Math. Soc. vol. 48 (1942) pp. 247–261). (Received June 24, 1944.)

233. Moses Richardson: *The pressure distribution on a body in shear flow.*

If the undisturbed shear flow is given by the velocity field $v_x=U(1+ky)$, $v_y=0$, where U and k are constants, then there exists a stream function $\psi(x, y)$ satisfying a Poisson equation $\nabla^2\psi=kU$ with certain boundary conditions on the smooth contour C of the cross section of an infinite cylindrical body immersed in the flow. Instead of attacking the boundary value problem for ψ directly, an integral equation is derived for the velocity distribution $v(s)$ on C, which may be solved by approximative methods. Knowledge of $v(s)$ implies knowledge of the pressure distribution on C. (Received July 7, 1944.)

234. Andrew Vazsonyi: *An existence theorem in the theory of compressible fluids.* Preliminary report.

Let ψ be the streamfunction of a *steady, adiabatic, irrotational, compressible* flow, q the velocity, ρ the density, $q^2\rho^2=\psi_x^2+\psi_y^2=\tau$ and $F(\tau)=\int^\tau d\tau/\rho(\tau)$. The Euler equation of the variational problem $\iint F(\psi_x^2+\psi_y^2)dxdy=\min$ is given by $\partial(\psi_x dF/d\tau)/\partial x+\partial(\psi_y dF/d\tau)/\partial y\equiv\partial(\rho^{-1}\psi_x)/\partial x+\partial(\rho^{-1}\psi_y)/\partial y=-\omega=0$ which shows that minimizing the integral $\iint F dx dy$ is equivalent to the condition of irrotationality. Hilbert conjectured that every regular variational problem is solvable. A. Haar showed (Math. Ann. vol. 97, p. 124) that this is indeed the case for the integral $\iint f(\psi_x, \psi_y)$. Haar's theorem cannot be applied directly for our case because ρ is a double valued function of τ. Furthermore τ has a maximum value τ_s at the speed of sound. However one can introduce a hypothetical "semi-compressible" fluid such that (a) for $\tau<\tau_s-\epsilon$, $p\rho^{-k}$ is (approximately) constant; (b) for $\tau>\tau_s-\epsilon$ the density is (approximately) constant; (c) the associated variational problem is regular. As a consequence of Haar's theorem *the interior boundary value problem is always solvable for such a semi-compressible fluid. The necessary and sufficient condition for the existence of a subsonic solution of a real compressible fluid is that for the* (*always existing*) "*semi-compressible*" *solution* $\tau<\tau_s$. It is believed that the theorem can be extended for the exterior problem too. (Received June 27, 1944.)

Geometry

235. Herbert Busemann: *Local metric geometry.*

The author studies systematically (not necessarily symmetric) metric spaces in which extremals exist. The local properties of such spaces are investigated first, for instance, segments are constructed which may replace the line elements of differential geometry. Convergence of extremals as point sets, sets of line elements, and curves is analyzed. Then a theory of parallelism between infinite rays in unbounded spaces is developed which is new also for the differentiable case. The theory of locally isometric spaces proves to be analogous to the topological theory of covering spaces with one noteworthy exception: compact and locally isometric spaces are congruent. Finally some of the fundamental theorems of differential geometry on spaces with constant curvature are derived without any differentiability assumptions. (Received June 17, 1944.)

236. Claude Chevalley: *Intersections of algebraic and algebroid varieties.*

The paper contains a local theory of intersections for algebroid and algebraic varieties. The definition of intersection multiplicities is based on the notion of multiplicities of a local ring with respect to a system of parameters as introduced in the author's paper on *The theory of local rings*, Ann. of Math. vol. 44, no. 4. (Received July 1, 1944.)

237. John DeCicco: *Conformal maps with isothermal systems of scale curves.*

Let a surface Σ be mapped conformally upon a plane Π. The scale function $\sigma=ds/dS$ depends only upon the position of the point. A scale curve is the locus of a point along which the scale σ does not vary. Under any conformal map of Σ upon Π there are ∞^1 scale curves (whereas in the nonconformal case there are ∞^2 scale curves). Any family (isothermal or not) of ∞^1 curves may represent the scale curves of a conformal map of some surface Σ upon the plane Π. The author considers the surfaces Σ of non-constant gaussian curvature which are applicable upon a surface of revolution for which there exists a conformal map of Σ upon Π with isothermal families of scale curves. Of course, any such surface Σ may be so mapped. In that case, the scale curves must be parallel straight lines or concentric circles. It is proved that there