the concentrational dependence of $\bar{n}$ (Fig. 1).

On the basis of the foregoing, models based on the coherent-potential approximation may be regarded as applicable to the given alloys [2]; on ordering, evidently, 3d electrons are delocalized in Ni$_3$(Mn, Ti) and localized in Ni$_3$(Fe, Ti), at high concentrations of Ti.

LITERATURE CITED


SELF-GRAVITATING WAVE FIELDS IN A GÖDEL SPACE

V. G. Krechet and I. B. Sandina

UDC 530.12:531.51

The properties of self-gravitating wave fields with integral spin (scalar and vector), compatible with a Götel type space, are investigated. The simultaneous systems of Einstein's gravitational field equations and the equations corresponding to wave fields in Götel's metric are solved. For the scalar field, the solutions are obtained for different types of interaction Lagrangians for the gravitational and scalar fields. It is shown that for a massive vector field the relations obtained between the constants lead, within the scope of the strong gravitation theory, to the classical expression for the spin of elementary particles.

The creation of the general theory of relativity first made it possible to formulate the problem of the structure and evolution of the universe (the cosmological problem) as a concrete physical problem. Einstein gave the first simple example of a solution of such a problem by constructing a model of the static universe. Fundamentally new cosmological solutions were obtained by the Soviet physicist A. Friedmann, who showed the impossibility of the existence of static cosmological models for matter in the form of an ideal fluid and constructed a model of a dynamic nonstationary universe.

These works aroused interest in constructing new cosmological models of a more complicated type. One of these unusually interesting models is the model of a Götdel-type space [1], obtained for the case of an ideal fluid with zero pressure. This homogeneous cosmological model has a number of interesting properties. It has rotational symmetry relative to any point and admits the existence of closed time-like curves.

These results have stimulated research on different interesting properties of space-time models, on the one hand, and searches for other possible distributions of matter, compatible with Götdel's solution on the other.

In this paper, we continue research along these lines. We examine self-gravitating wave fields: massive vector and scalar fields with different types of interactions in Götdel type spaces with the metric...
\[ ds^2 = -dt^2 + dx^2 - \frac{1}{2} v^2 dy^2 + dz^2 - 2vdt dy, \]  \hspace{1cm} (1)

where, \( v \) is a function of \( x \). For \( v = e^{\sqrt{2}\omega t} \), we have Gödel's solution which he obtained for an ideal fluid without pressure, where \( \omega \) is a constant, which is the angular rotational velocity of the velocity vector of the fluid \( u_x \) and is related to the energy density by the relation \( 4\pi \rho = \omega^2 = -\Lambda \), where \( \Lambda \) is the cosmological constant.

1. MASSIVE VECTOR FIELD

The Lagrangian of the system of gravitational and massive vector fields in the general case has the form

\[ L = \sqrt{-g} \left( R + \frac{2}{3} F_{\alpha\beta} F^{\alpha\beta} - 2\mu^2 A_\alpha A^\alpha + 2\Lambda \right), \]  \hspace{1cm} (2)

where \( \beta = 2\pi \), and \( A_\alpha \) is the 4-potential of the vector field, while \( F_{\alpha\beta} = \nabla_\alpha A_\beta - \nabla_\beta A_\alpha \equiv \partial_\alpha A_\beta - \partial_\beta A_\alpha \) in a Riemannian space. From symmetry considerations, we choose the 4-potential of the field in the form

\[ A_\alpha = \partial_\alpha \phi (x), \]  \hspace{1cm} (3)

Then, the tensor field \( F_{\alpha\beta} \) has only a single nonzero component

\[ F_{\alpha t} = \phi' (\phi' \equiv d\phi/dx). \]

Taking into account (1) and (3), Lagrangian (2) takes the form

\[ L = \frac{\phi'}{V^2} \left( \frac{v'^2}{v^2} + 2\beta^2 \phi'^2 - 2\mu^2 \phi^2 + \Lambda \right). \]  \hspace{1cm} (4)

Varying (4) independently with respect to \( \phi \) and \( \phi' \), we obtain a system of Einstein's equations and the equations for a massive vector field in Gödel's space:

\[ \left( \frac{\phi''}{\phi} - \frac{1}{2} \frac{v'^2}{v^2} \right) - \frac{\mu^2}{\phi^2} \phi' + \frac{\mu^2}{\phi^2} = 0, \]  \hspace{1cm} (5a)

\[ \phi'' + \frac{\phi'}{\phi} + \mu^2 \phi = 0. \]  \hspace{1cm} (5b)

It is easy to show that Gödel's solution \( v = e^{\sqrt{2}\omega t} \) satisfies this system. Then, the equation for the vector field (5b) has the solution \( \phi = ce^{-\mu t} \) (\( c \) is a constant of integration), while the constants \( \Lambda, \mu, \) and \( \omega \) are related by the relations:

\[ \Lambda = \omega^2, \quad \mu = \frac{\sqrt{2}}{2} \omega; \quad \mu^2 = \frac{1}{2} \Lambda \text{ (i.e., } \mu^2 \sim \Lambda). \]  \hspace{1cm} (6a)

Therefore,

\[ \phi = c V \sqrt{v}. \]  \hspace{1cm} (6b)

Thus, just as in the case of spherical symmetry [2], the solution for a self-gravitating massive vector field is characterized by the same relation between the constant \( \mu \) and the cosmological constant \( \Lambda \) (\( \Lambda \sim \mu^2 \)).

According to present-day estimates, \( \Lambda \approx 10^{-64} \text{ cm}^{-2} \), and we obtain from relation (6a) for \( \mu = me/h \) a quantity of the order of \( 10^{-28} \text{ cm}^{-1} \), which corresponds to a mass of \( 10^{-66} \text{ g} \) for the vector particle. This quantity is also characteristic for present-day estimates of the photon mass (if it exists). Indeed, in the case of a closed universe, the Compton wavelength of a photon cannot be greater than the radius of the universe, i.e., it will be finite. This