# Recent Publications of Members

*In this section are printed the abstracts of articles published recently by the members of the Physical Society of the Republic of China in foreign journals.*

## Yang's Gravitational Field Equations

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[Physical Review Letters, Vol. 35, No. 5, pp. 319-320 (4 August 1975)]

Yang's gravitational field equations in *vacuo* can be regarded as "derivative" equations of both Einstein's equations and Nordström's equations, and embrace all their solutions. Yang's equations admit monopole gravitational radiations; therefore no analog of the Birkhoff theorem can be valid. The most general static spherical-symmetric solution contains four arbitrary parameters. In particular, $ds^2 = -dt^2 + (1 + c_1/r + c_2 r^2)^{-1} dr^2 + r^2 (d\theta^2 + \sin^2\theta d\varphi^2)$ is a two-parameter exact solution. This metric possesses no gravitational red shifts.

## Pulse Propagation and Superradiance

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We give a theoretical description of optical-pulse propagation through a resonant medium and superradiance and use various methods to obtain analytic solutions for the semi-classical equations which have been extensively employed in quantum optics. A criterion for nonlinear absorption is given, which depends on the amplitude and the rise-time of the input pulse, and the lifetime of the excited state and the relaxation time of the medium. Intensity-dependent absorption, compression of pulse duration and light amplification in saturable absorbers are demostrated. We show that saturation occurs for an intense incident radiation field such that the medium becomes an optically thin system. Saturation also occurs for a long-rise-time incident pulse as shown in the study of propagation of step-function pulses. We obtain the maximal gain per unit length, and the maximal amplification and emission from a superradiant state which is only linearly proportional to the length of the medium, instead of an exponential dependence which would need so large an energy that the medium cannot provide it. We calculate the co-operative decay lifetime, the half-width of the Fourier spectrum and the field intensity of the co-operatively emitted radiation for certain cases. We also investigate self-induced transparency and derive an area theorem which is different from that of McCall and Hahn, though qualitatively similar to it.