Low pumping energy mode of the “optical bars”/“optical lever” topologies of gravitational-wave antennae

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abstract
The “optical bars”/“optical lever” topologies of gravitational-wave antennae allow to obtain sensitivity better that the Standard Quantum Limit while keeping the optical pumping energy in the antenna relatively low. Element of the crucial importance in these schemes is the local meter which monitors the local test mirror position. Using cross-correlation of this meter back-action noise and its measurement noise it is possible to further decrease the optical pumping energy. In this case the pumping energy minimal value will be limited by the internal losses in the antenna only. Estimates show that for values of parameters available for contemporary and planned gravitational-wave antennae, sensitivity about one order of magnitude better than the Standard Quantum Limit can be obtained using the pumping energy about one order of magnitude smaller energy than is required in the traditional topology in order to obtain the the Standard Quantum Limit level of sensitivity.