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Helical undulators from magnetized helices and ring sectors

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A periodic system of spirally arranged magnetized annular sectors creates near the axis a helical field, which is close in structure and magnitude to the field in the set of helical magnets. Such a system of relatively few available magnets can be easier to manufacture and assemble than a system containing magnetized helices made from a single piece. In this paper, we theoretically study the dependence of the helical field on the number of sectors per undulator period. Short prototypes consisting of longitudinally and radially magnetized sectors, as well as a hybrid system assembled from longitudinally magnetized NdFeB sectors and preliminarily non-magnetized steel helices, was experimentally studied. The maximum measured value of the field on the axis of an undulator with a period of 2 cm and a relatively large inner diameter of 8 mm is 0.7 T. Such undulators can provide a large oscillatory electron velocity and seem promising for increasing the efficiency of FELs and IFELs in various frequency ranges.

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Footnotes

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