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Nontopological solitons in Abelian gauge theories coupled to $U(1) \times U(1)$ symmetric scalar fields

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In a series of recent works, Ishihara and Ogawa have investigated nontopological solitons (Q-balls) in a spontaneously broken Abelian gauge theory coupled to two complex scalar fields. The present paper extends their investigations to the most general $U(1) \times U(1)$ symmetric quartic potential. Also, a new class of charged Q-ball solutions with vanishing self-interaction terms is investigated and some of their remarkable properties are exhibited.

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