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Submitted: 20 November 2021

Accepted: 04 January 2022

Published Online: 25 January 2022

# Bound photoinduced giant spin polaron in EuTe

Journal of Applied Physics **131**, 043903 (2022); <https://doi.org/10.1063/5.0079384>

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Previously, we showed that at low temperatures and very low excitation powers, EuTe displays band-edge photoluminescence with a well-resolved phonon structure, the so-called  $\text{MX}_0$  band, which is associated with the recombination of giant spin polarons (SPs) of magnetic moments of several hundred Bohr magnetons. Here, we investigate the  $\text{MX}_0$  band both experimentally and by Monte Carlo simulations. Results indicate that the SPs are bound to defects, with a localization energy of 0.29 eV. The density of defects harboring the SPs is estimated to be  $4.3 \times 10^{15} \text{ cm}^{-3}$ .

## ACKNOWLEDGMENTS

A. B. H. acknowledges support by CNPq (Grant Nos. 420531/2018-1 and 303757/2018-3) and FAPESP (Grant No. 2020/15570-0).

## REFERENCES

1. P. G. de Gennes, Phys. Rev. **118**, 141 (1960).  
<https://doi.org/10.1103/PhysRev.118.141>, [Google Scholar](#), [Crossref](#), [ISI](#)
2. T. Kasuya, A. Yanase, and T. Takeda, Solid State Commun. **8**, 1543 (1970). [https://doi.org/10.1016/0038-1098\(70\)90604-6](https://doi.org/10.1016/0038-1098(70)90604-6),  
[Google Scholar](#), [Crossref](#)
3. E. L. Nagaev, Phys. Status Solidi B **145**, 11 (1988).  
<https://doi.org/10.1002/pssb.2221450102>, [Google Scholar](#), [Crossref](#)



4. A. Mauger and D. L. Mills, Phys. Rev. Lett. **53**, 1594 (1984).  
<https://doi.org/10.1103/PhysRevLett.53.1594>, [Google Scholar](#),  
[Crossref](#)

---

5. A. Mauger and D. L. Mills, Phys. Rev. B **31**, 8024 (1985).  
<https://doi.org/10.1103/PhysRevB.31.8024>, [Google Scholar](#), [Crossref](#)

---

6. A. B. Henriques, F. C. D. Moraes, G. D. Galgano, A. J. Meaney, P. C. M. Christianen, J. C. Maan, E. Abramof, and P. H. O. Rappl, Phys. Rev. B **90**, 369 (2014). <https://doi.org/10.1103/PhysRevB.90.165202>,  
[Google Scholar](#), [Crossref](#)

---

7. J. Kossut and J. A. Gaj, *Introduction to the Physics of Diluted Magnetic Semiconductors*, Springer Series in Materials Science Vol. 144 (Springer, 2010). [Google Scholar](#)

---

8. V. G. Storchak, O. E. Parfenov, J. H. Brewer, P. L. Russo, S. L. Stubbs, R. L. Lichti, D. G. Eshchenko, E. Morenzoni, T. G. Aminov, V. P. Zlomanov, A. A. Vinokurov, R. L. Kallaher, and S. von Molnár, Phys. Rev. B **80**, 235203 (2009). <https://doi.org/10.1103/PhysRevB.80.235203>,  
[Google Scholar](#), [Crossref](#)

---

9. A. B. Henriques, G. D. Galgano, E. Abramof, B. Diaz, and P. H. O. Rappl, Appl. Phys. Lett. **99**, 091906 (2011). <https://doi.org/10.1063/1.3634030>,  
[Google Scholar](#), [Scitation](#), [ISI](#)

---

10. A. B. Henriques, G. D. Galgano, P. H. O. Rappl, and E. Abramof, Phys.



- 
11. A. B. Henriques, X. Gratens, P. A. Usachev, V. A. Chitta, and G. Springholz, Phys. Rev. Lett. **120**, 217203 (2018).  
<https://doi.org/10.1103/PhysRevLett.120.217203>, [Google Scholar](#), [Crossref](#)
- 
12. X. Gratens, Y. Ou, J. S. Moodera, P. H. O. Rappl, and A. B. Henriques, Appl. Phys. Lett. **116**, 152402 (2020). <https://doi.org/10.1063/1.5143311>, [Google Scholar](#), [Scitation](#), [ISI](#)
- 
13. S. C. P. van Kooten, X. Gratens, and A. B. Henriques, Phys. Rev. B **103**, 035202 (2021). <https://doi.org/10.1103/PhysRevB.103.035202>, [Google Scholar](#), [Crossref](#)
- 
14. E. Granado, E. Abramof, P. H. O. Rappl, V. A. Chitta, and A. B. Henriques, Phys. Rev. B **78**, 175 (2008).  
<https://doi.org/10.1103/PhysRevB.78.134423>, [Google Scholar](#), [Crossref](#)
- 
15. A. B. Henriques, G. D. Galgano, B. L. Díaz, P. H. O. Rappl, and E. Abramof, J. Phys.: Condens. Matter **19**, 406234 (2007).  
<https://doi.org/10.1088/0953-8984/19/40/406234>, [Google Scholar](#), [Crossref](#)
- 
16. A. Mauger and C. Godart, Phys. Rep. **141**, 51 (1986).  
[https://doi.org/10.1016/0370-1573\(86\)90139-0](https://doi.org/10.1016/0370-1573(86)90139-0), [Google Scholar](#), [Crossref](#)



17. A. B. Henriques, A. Wierds, M. A. Manfrini, G. Springholz, P. H. O. Rappl, E. Abramof, and A. Y. Ueta, Phys. Rev. B **72**, 155337 (2005).  
<https://doi.org/10.1103/PhysRevB.72.155337>, [Google Scholar](#), [Crossref](#)

---

18. A. B. Henriques, M. A. Manfrini, P. H. O. Rappl, and E. Abramof, Phys. Rev. B **77**, 035204 (2008).  
<https://doi.org/10.1103/PhysRevB.77.035204>, [Google Scholar](#), [Crossref](#)

---

19. A. B. Henriques and P. A. Usachev, Phys. Rev. B **96**, 679 (2017).  
<https://doi.org/10.1103/PhysRevB.96.195210>, [Google Scholar](#), [Crossref](#)

---

20. S. C. P. van Kooten, P. A. Usachev, X. Gratens, A. R. Naupa, V. A. Chitta, G. Springholz, and A. B. Henriques, J. Appl. Phys. **126**, 095701 (2019). <https://doi.org/10.1063/1.5116150>, [Google Scholar](#), [Scitation](#), [ISI](#)

---

21. B. Kaminski *et al.*, Phys. Rev. Lett. **103**, 057203 (2009).  
<https://doi.org/10.1103/PhysRevLett.103.057203>, [Google Scholar](#), [Crossref](#)

---

22. A. B. Henriques, E. Abramof, and P. H. O. Rappl, Phys. Rev. B **80**, 301 (2009). <https://doi.org/10.1103/PhysRevB.80.245206>, [Google Scholar](#), [Crossref](#)



Rappl, and M. Bayer, Phys. Rev. B **82**, 235206 (2010).

<https://doi.org/10.1103/PhysRevB.82.235206>, [Google Scholar](#),  
[Crossref](#)

---

24. G. D. Holah, J. S. Webb, R. B. Dennis, and C. R. Pidgeon, Solid State Commun. **13**, 209 (1973).

[https://doi.org/10.1016/0038-1098\(73\)90227-5](https://doi.org/10.1016/0038-1098(73)90227-5), [Google Scholar](#),  
[Crossref](#)

---

25. A. B. Henriques and J. P. von der Weid, Solid State Commun. **56**, 571 (1985). [https://doi.org/10.1016/0038-1098\(85\)90957-3](https://doi.org/10.1016/0038-1098(85)90957-3),

[Google Scholar](#), [Crossref](#)

---

26. H. B. Bebb and E. W. Williams, in *Semiconductors and Semimetals* (Academic Press, London, 1972), Vol. 8, p. 299. [Google Scholar](#)

---

27. P. J. Dean and D. C. Herbert, in *Topics in Current Physics* (Springer-Verlag, Berlin, 1979), Vol. 14, p. 55. [Google Scholar](#), [Crossref](#)

---

28. B. K. Meir, in *Zinc Oxide: From fundamental properties towards novel applications*, Springer Series in Materials Science (Springer-Verlag, Berlin, 2010), Vol. 120, p. 169.

<https://doi.org/10.1007/978-3-642-10577-7>, [Google Scholar](#),  
[Crossref](#)

---

29. J. Vinins and P. Wachter, Phys. Rev. B **12**, 3829 (1975).

<https://doi.org/10.1103/PhysRevB.12.3829>, [Google Scholar](#), [Crossref](#)



30. P. Wachter, CRC Crit. Rev. Solid State Sci. **3**, 189 (1972).  
<https://doi.org/10.1080/10408437208244865>, [Google Scholar](#),  
[Crossref](#)
- 
31. N. F. Oliveira, S. Foner, and Y. Shapira, Phys. Rev. B **5**, 2634 (1972).  
<https://doi.org/10.1103/PhysRevB.5.2634>, [Google Scholar](#), [Crossref](#)
- 
32. W. Söllinger, W. Heiss, R. T. Lechner, K. Rumpf, P. Granitzer, H. Krenn, and G. Springholz, Phys. Rev. B **81**, 155213 (2010).  
<https://doi.org/10.1103/PhysRevB.81.155213>, [Google Scholar](#),  
[Crossref](#)
- 
33. J. W. Battles and G. E. Everett, Phys. Rev. B **1**, 3021 (1970).  
<https://doi.org/10.1103/PhysRevB.1.3021>, [Google Scholar](#), [Crossref](#)
- 
34. T. Dietl and J. Spalek, Phys. Rev. Lett. **48**, 355 (1982).  
<https://doi.org/10.1103/PhysRevLett.48.355>, [Google Scholar](#),  
[Crossref](#)
- 
35. T. Dietl, J. Magn. Magn. Mater. **38**, 34 (441983).  
[https://doi.org/10.1016/0304-8853\(83\)90099-9](https://doi.org/10.1016/0304-8853(83)90099-9), [Google Scholar](#),  
[Crossref](#)
- 
36. W. Heiss, R. Kirchschrager, G. Springholz, Z. Chen, M. Debnath, and Y. Oka, Phys. Rev. B **70**, 484 (2004).  
<https://doi.org/10.1103/PhysRevB.70.035209>, [Google Scholar](#),  
[Crossref](#)



and E. Abramof, Phys. Rev. B **95**, 045205 (2017).

<https://doi.org/10.1103/PhysRevB.95.045205>, [Google Scholar](#),  
[Crossref](#)

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