**Rourke *et al.* Reply:** In our Letter [1], we reported point contact spectroscopy (PCS) measurements on $CeCoIn_5$ single crystals, showing multiple structures which depend on junction impedance and temperature. Using superpositions of Andreev surface and bulk states, we interpreted our data as evidence for two coexisting order-parameter (OP) components containing gap nodes. The Comments by Sheet and Raychaudhuri [2(a)] and by Park and Greene [2(b)] argue that: (1) Our point contacts were not ballistic; (2) our spectral features are due to contact heating; (3) our Andreev peaks should show magnetic-field evolution; (4) junction directionality is needed to justify our data. We show that none of these are valid claims which would affect our results and give experimental reasons why Park *et al.* [3] do not observe our results on $CeCoIn_5$ [1].

In our Letter, we used the Sharvin formula to show that our point contacts were predominantly ballistic. Here we reestablish this ballisticity using the more exact Wexler formula with recently published values for the mean free path $l$ of $CeCoIn_5$ [4]. For the data in our Fig. 1(a) [1], we use impedance $R \sim 0.4\ \Omega$, resistivity $\rho \sim 1.0\ \mu\Omega$ cm [5], and $l \sim 1600$ nm [4] in the formula $R = 4\rho l/3\pi a^2 + \rho/4a$ to get a contact radius $a \sim 133$ nm. This calculation puts our data well in the *ballistic* ($a \ll l$) regime, even if diameter were considered. It is unlikely that this ballistic estimate could vary, since our batch of $CeCoIn_5$ crystals showed consistent $\rho$ values [5] which were comparable to those measured in Ref. [4]. Even if our point contacts were nonballistic, the Blonder-Tinkham-Klapwijk (BTK) formalism has been extended to show that it remains valid [6].

On the possibility of contact heating, the Comments have made an invalid comparison of our Pt-Ir/$CeCoIn_5$ data with their Au/$MgB_2$ and Nb/Fe data. First, the $MgB_2$ thin films were polycrystalline, where intergranular Josephson tunneling could produce spurious zero-bias peaks [7]. Second, the Nb/Fe data were taken in the *thermal* ($a \gg l$) regime, while the ferromagnetic Fe film could also induce magnetic pair breaking in the Nb tip. Third, the spectral dips in the purported contact-heating model [8] show an *opposite* dependence on contact impedance than in our data [1]: whereas our dips diminish with, their dips are enhanced by, lower impedance. Therefore, the contact-heating model cannot explain our data. We emphasize that peak and dip structures are intrinsic to Andreev surface states [9] and were also seen in Goll *et al.*'s PCS data on $CeCoIn_5$ [10].

Regarding our Andreev peak spectra, the magnetic-field diagnostics suggested by the Comments are not well established. First, Doppler splitting of Andreev peaks is not generally observed, particularly when $H_{c2}$ and $T_c$ are low [11], and recent tunneling studies on $YBa_2Cu_3O_{6+x}$ [12,13] have raised questions about its robustness. Second, although Zeeman splitting of Andreev peaks is theoretically possible [14], this has not been experimentally observed on any superconductor.

On the issue of junction directionality, the Comments have also exaggerated their claims. While directional spectroscopy [9] would help to determine the exact OP symmetry of $CeCoIn_5$, this was not the focus of our Letter. In fact, since low-impedance junctions have wide momentum cones [9] and chemical etching tends to produce surface roughness, it is doubtful that any of the PCS data on $CeCoIn_5$ [1,3,10] so far has provided directional information. A precise determination of the OP symmetry of $CeCoIn_5$ would require varying *both* junction orientation and impedance [9] and extending the generalized BTK theory beyond its 2D formulation. Given the complex band structure of $CeCoIn_5$, with both 2D and 3D Fermi-surface sheets [15], a nodal OP symmetry more complex than either $d_{x^2-y^2}$ or $d_{xy}$ cannot be ruled out.

The discrepancies between our data [1] and Park *et al.*'s data [3] are most likely due to differences in measurement technique. First, Park *et al.* used piezo-driven soft Au tips which could blunt easily, whereas we used spring-cushioned hard Pt-Ir tips which stay robust. Second, whereas we used a pulsed bias current to prevent Joule heating, Park *et al.* used a dc bias current which would produce the large spectral smearing they observed. This explains why they do not see the higher-bias hump structure observed in both our data [1] and Goll *et al.*'s data [10].

P. M. C. Rourke,[1] M. A. Tanatar,[1] C. S. Turel,[1] C. Petrovic,[2] and J. Y. T. Wei[1]
[1]Department of Physics
University of Toronto
Toronto, ON, M5S 1A7 Canada
[2]Department of Physics
Brookhaven National Laboratory
Upton, New York 11973, USA

Received 8 April 2006; published 29 June 2006
DOI: 10.1103/PhysRevLett.96.259703
PACS numbers: 74.70.Tx, 74.20.Rp, 74.45.+c, 74.50.+r

[1] P. M. C. Rourke *et al.*, Phys. Rev. Lett. **94**, 107005 (2005).
[2] Preceding Comments: (a) G. Sheet and P. Raychaudhuri, Phys. Rev. Lett. **96**, 259701 (2006); (b) W. K. Park and L. H. Greene, *ibid.* **96**, 259702 (2006).
[3] W. K. Park *et al.*, Phys. Rev. B **72**, 052509 (2005); Proc. SPIE-Int. Soc. Opt. Eng. **5932**, 283 (2005).
[4] Y. Kasahara *et al.*, Phys. Rev. B **72**, 214515 (2005).
[5] J. Paglione *et al.*, Phys. Rev. Lett. **91**, 246405 (2003).
[6] Y. Tanaka *et al.*, Phys. Rev. B **69**, 144519 (2004).
[7] P. J. M. van Bentum *et al.*, Phys. Rev. B **36**, 843 (1987).
[8] G. Sheet *et al.*, Phys. Rev. B **69**, 134507 (2004).
[9] J. Y. T. Wei *et al.*, Phys. Rev. Lett. **81**, 2542 (1998).
[10] G. Goll *et al.*, Acta Phys. Pol. B **34**, 575 (2003).
[11] A. Biswas *et al.*, Phys. Rev. Lett. **88**, 207004 (2002).
[12] R. Beck *et al.*, Phys. Rev. B **72**, 104505 (2005).
[13] J. Ngai *et al.*, Phys. Rev. B **72**, 054513 (2005).
[14] Q. Cui, C. R. Hu, J. Y. T. Wei, and K. Yang, cond-mat/0510717 [Phys. Rev. B (to be published)].
[15] R. Settai *et al.*, J. Phys. Condens. Matter **13**, L627 (2001).

 