Which are More Fundamental, Electromagnetic Fields or Potentials?

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Because the electromagnetic fields **E** and **B** can be deduced from knowledge of the electromagnetic potentials V and **A**, the latter are often considered to be more "fundamental" than the former. However, the potentials V and **A** can be deduced from the fields **E** and **B** via an argument attributed to Poincaré [1], so it is not self evident which is more "fundamental" than the other.[1]

References

[1] W.E. Brittin, W.R. Smythe and W. Wyss, *Poincaré gauge in electrodynamics*, Am. J. Phys. **50**, 693-696 (1982). https://doi.org/10.1119/1.12731
https://kirkmcd.princeton.edu/examples/EM/brittin_ajp_50_693_82.pdf

[2] K.T. McDonald, *Vector Potential of a Long Solenoid in the Poincaré Gauge* (January 15, 2017). https://kirkmcd.princeton.edu/examples/poincare.pdf

[3] Y. Aharonov and D. Bohm, *Significance of Electromagnetic Potentials in Quantum Theory*, Phys. Rev. **115**, 485-491 (1959). https://doi.org/10.1103/PhysRev.115.485
http://kirkmcd.princeton.edu/examples/QM/aharonov_pr_115_485_59.pdf

[1] Consideration of the vector potential in the Poincaré gauge [2] in the Aharanov-Bohm [3] effect indicates that one should not suppose that the vector potential always provides a "local" explanation of this effect.