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Deep Brain Stimulation Alters Sleep Physiology and Architecture in Parkinson's Disease: A Prospective, Multi-Night, Naturalistic Polysomnography Study

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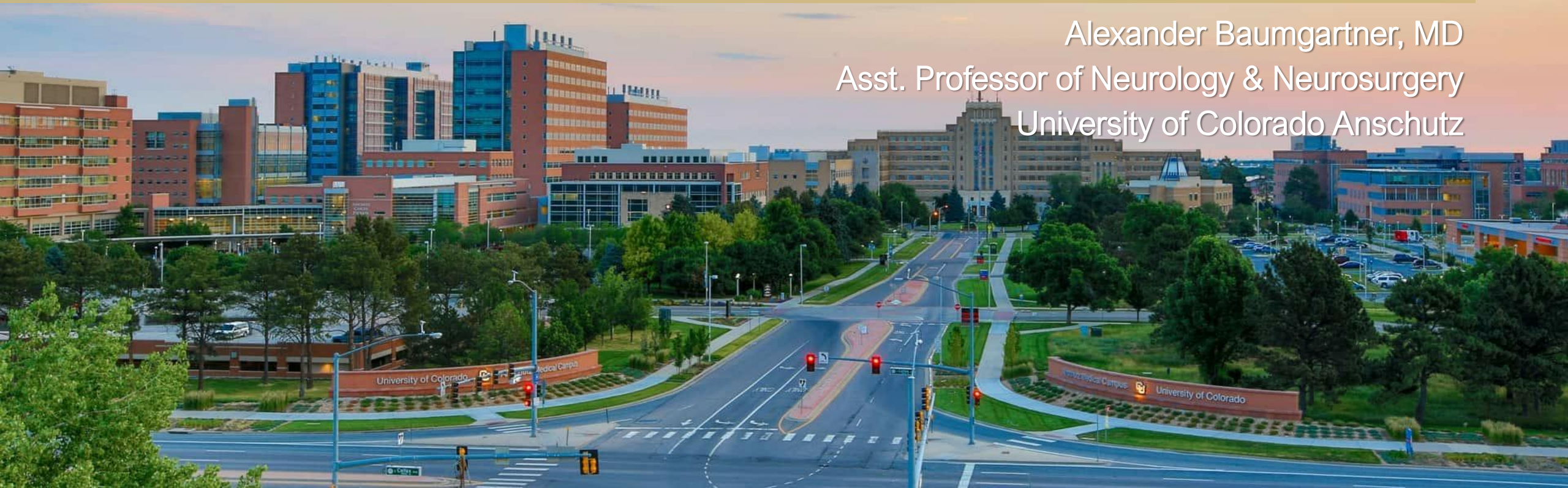

Background

- Sleep dysfunction is a major source of morbidity in both early and advanced Parkinson disease (PD), predicts accelerated disease progression, and increases risk of dementia
- DBS may improve sleep in PD, but so far this benefit remains largely incidental
- Basal ganglia DBS targets likely play a key pathophysiological role in PD insomnia
- *Knowledge gap:*
  1) Few studies have used an objective measure to assess the impact of DBS on sleep in PD
  2) The effect of dopaminergic medication on sleep in relation to DBS remains poorly characterized

Objective

- Obtain a robust, objective assessment of the effect of DBS on sleep architecture and physiology in PD

Methods

- 15 patients with PD were recruited for in-home sleep monitoring before and after DBS implantation
- Sleep data were obtained at home using a validated wearable device over multiple nights in four conditions: off-stim/on-med, off-stim/off-med, on-stim/on-med, and on-stim/off-med
- Spectral power and slow wave (SW) and spindle (SP) metrics were extracted from EEG data

Data

- 11 participants (8 M, 3 F) had data available both pre- and post-DBS implantation and were included in the analysis
- Mean (SD) age was 65.4 (8.5) years, mean disease duration was 10.6 (4.6) years
- 9 bilateral STN DBS, 2 bilateral GPi DBS
- 95 nights were analyzed

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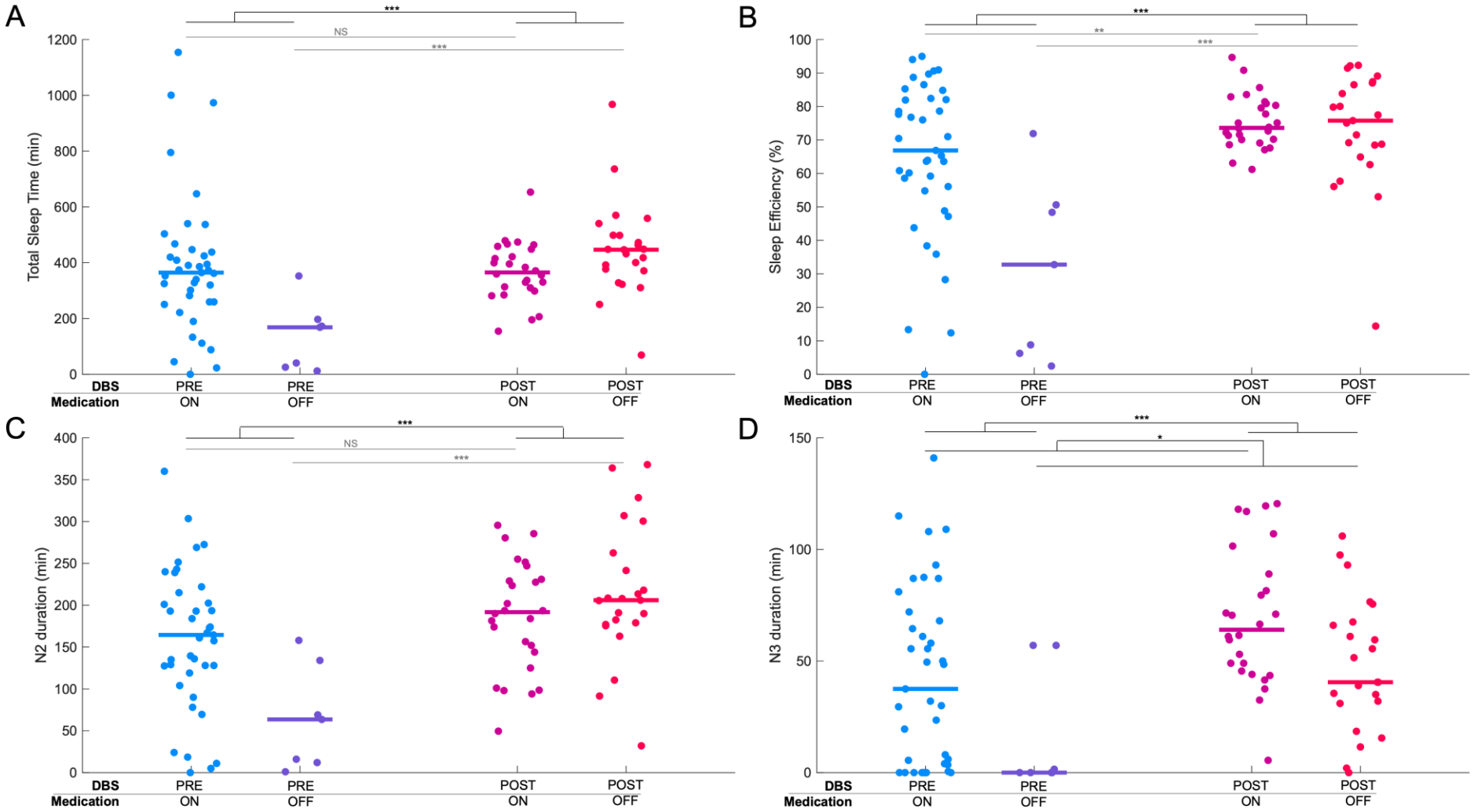
Sleep continuity and architecture are improved by both DBS and dopaminergic medication, and the effects of DBS are more pronounced in the off-medication state.



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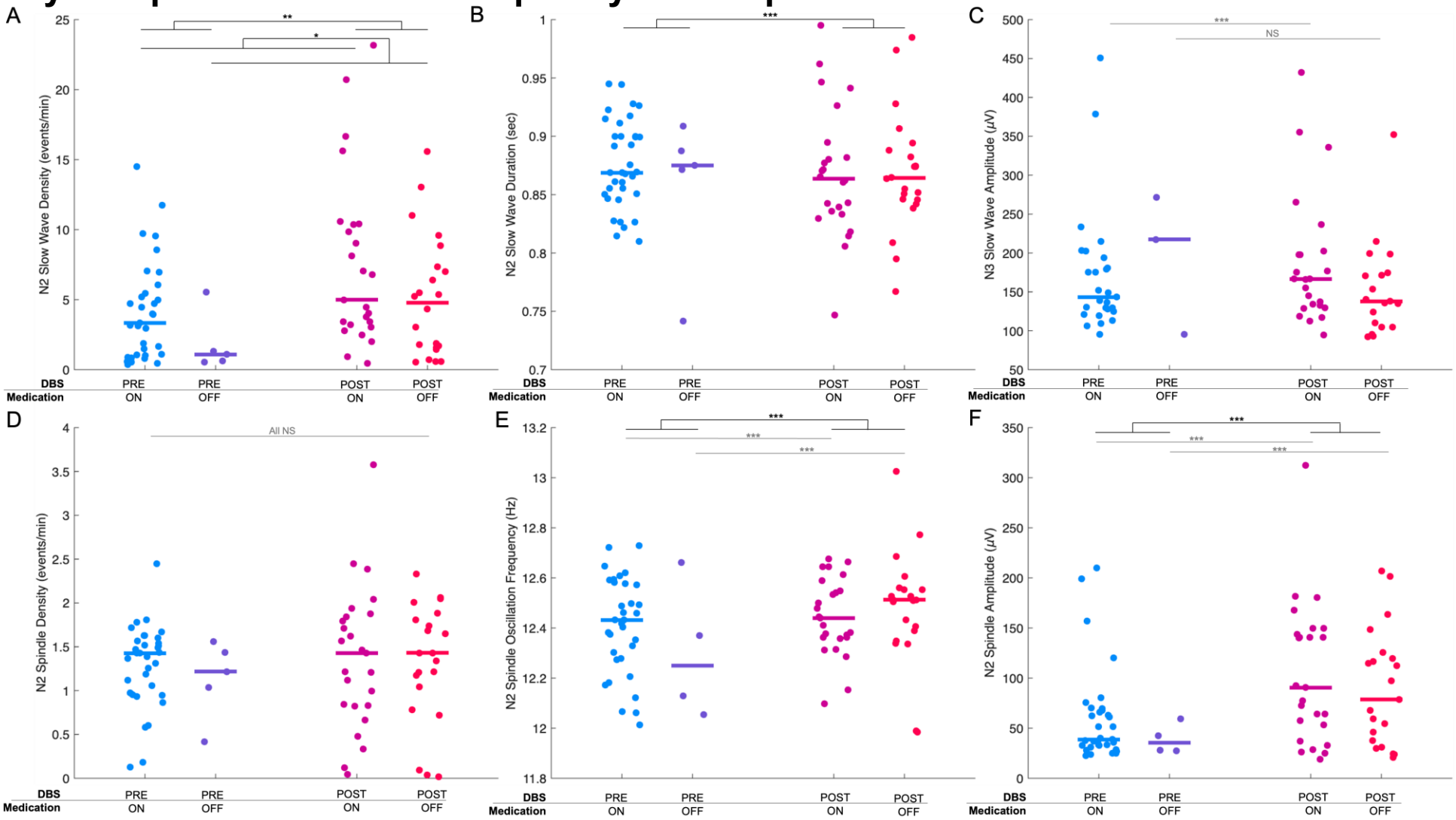
Sleep microarchitectural features are affected by both DBS and dopaminergic medication, particularly N2 spindle oscillation frequency and amplitude.



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Conclusion

- DBS improved subjective sleep quality and fatigue
- DBS improved total sleep time, N2 and N3 sleep duration, sleep onset latency (SOL), wakefulness duration, and sleep efficiency with large effect sizes
- SP density was not affected by DBS, but SP oscillation frequency and amplitude in N2 were increased after DBS

Future Directions

- Future studies will evaluate the potential for the optimization of DBS to enhance sleep, and therapeutic implications of altering sleep microarchitecture
- Tailoring DBS therapy for sleep enhancement would represent a substantial advancement in the search for improved treatments for sleep dysfunction in PD


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