

# Alexander T. Graf, PhD

Oakland, CA - Phone: 510 990 2734, email: [alexgraf@gmail.com](mailto:alexgraf@gmail.com)

Google Scholar [goo.gl/RvzxGs](https://scholar.google.com/citations?user=goo.gl/RvzxGs) - LinkedIn [goo.gl/Npw8cw](https://www.linkedin.com/in/goo.gl/Npw8cw) - **gitcv** [goo.gl/w7mMmR](https://gitcv.goo.gl/w7mMmR)

## Experience

---

### **11-16 to pres. General Electric Digital - Sr. Staff Data Scientist**

- Nuclear power generation asset maintenance optimization - reliability growth
- Food and Beverage plastic film production anomaly detection, breakage avoidance
- Unsupervised / Semi-supervised anomaly detection on multivariate time series for Army transport vehicles (DPGMM on moving window covariance).
- Health prediction for beef cattle (Ensemble classification)
- Root cause analysis for hypoxic US Navy F18 pilots (LDA topic modeling, partial dependence investigations, predictive model feature importance)
- Data validation and reconciliation (sensor failure detection)
- POC development with a high degree of customer engagement

### **02-16 to 11-16 General Electric Digital - Interim Manager of Data Science Services Team (~18 people)**

- Lead the vision and strategy for group success.
- Manage expectations and guide careers of team members.

### **06-13 to 02-16 General Electric Digital - Staff Data Scientist**

- Unsupervised anomaly detection on multivariate time series with feature importance for jet engines (Graphical Granger Causality)
- Semi-supervised learning applied to fault classification for jet engines
- Domain adaptation on continuous data for jet engines (MMDE and Tradaboost)
- Wavelet clustering on multivariate time series for fault identification
- Survival analysis (Random Survival Forest)
- Change point detection on multivariate time series (rank permutation)
- Bias correction and sampling methods for general application (resampling methods)
- Code and product development, internal white paper composition and various other lower level out-of-the-box analytics.

### **07-09 to 08-12 Lawrence Livermore National Laboratory (LLNL) - Postdoctoral Scientist (DoE Q cleared)**

- X-ray probing of ultrafast processes in x-ray irradiated crystals
  - Project lead with responsibilities including diagnostic planning and construction, experimental execution, budget and people management (10 person team)
  - Data analysis included signal processing and multi-parameter regression on large data sets
- Photo-ionization and excitation measurements
  - Collaborator with responsibilities including planning and implementation of short pulse x-ray spectroscopic diagnostic
  - Data analysis required careful calibration, signal processing and noise suppression using time coincidence

### **12-05 to 12-08 MIT Plasma Science and Fusion Center - Visiting Graduate Student / Research Assistant**

- Plasma flow and temperature measurements in a tokamak
  - Project Lead with responsibilities including experiment organization, execution, diagnostic construction and budget management, coordination with larger 50+ person team.
  - Instrument control and time synchronized data acquisition / data base integration
  - Signal processing, multi-parameter regression, statistical significance testing
  - Monte Carlo modeling of neutral particle trajectories

### **12-02 to 12-05 LLNL - Visiting Graduate Student / Research Assistant**

- X-ray spectroscopic measurements of astrophysical relevance

## Education

---

12-08 **Ph.D. (Plasma Physics)** University of California at Davis (GPA 3.8)  
12-05 to 12-08 Visiting Graduate Student at the MIT Plasma Science and Fusion Center  
12-04 **M.Sc (Physics)** University of California at Davis  
06-00 **B.Sc. (Physics)** University of North Florida

## Technical interests

---

- NLP / Text Mining topics adapted to multivariate time series analysis (e.g. SAX and distributed word representations for unsupervised pre-training)
- Deep Learning topics for time series

## Math and Computational Skills

---

Machine Learning, Probability and Statistics, Time Series Analysis, Calculus, Linear Algebra, Real and Complex Analysis, ODE/PDE, Numerical Analysis, Foundational Algorithms, Optimization

Python, R, Matlab, Git (Fluent) – AWS, Java, SQL, Spark, Javascript, D3, Bokeh (Functional)

## Patents

---

- (Pending) Operator health proxy using adapted fatigue measures
- A Framework for Unsupervised Anomaly Detection on Industrial Time Series Data
- (Pending) Transfer Learning for Aviation Damage Models

## Publications

---

**A. Graf**, “The Development of Benchmark Data Sets for Industrial Assets”, Internal GE White Paper (2015)

**A. Graf**, “A Visible Spectral Survey in the Alcator C-Mod Tokamak”, **Canadian Journal of Physics** 89:(5), p. 615 (2011)

**A. Graf**, “Measurement and Modeling of Na-like Fe XVI Inner-shell Satellites Between 14.5 Å and 18 Å”, **Astrophysical Journal**, 695, 818 (2009)

**A. Graf**, “Multichannel Doppler Transmission Grating Spectrometer at the Alcator C-Mod Tokamak”, **Review of Scientific Instruments**, 79, 10F544 (2008)

**A. Graf**, “Spectroscopy on Magnetically Confined Plasmas using Electron Beam Ion Trap Spectrometers”, **Canadian Journal of Physics** 86, 307 (2008)

**A. Graf**, “Lifetime of the  $1s2p\ ^1P_1$  Excited Level in  $Fe^{24+}$ ”, Spectral Line Shapes: Volume 12, **16th ICSLS, AIP Conf. Proc.** CP645, edited by C. A. Back (American Institute of Physics, New York, 2002), p. 74-78

## Co-Author Publications

---

W. Wierzchowski et al., Synchrotron topographic evaluation of strain around craters generated by irradiation with x-ray pulses from free electron lasers with different intensities, **Nuclear Instruments and Methods in Physics Research** Section B, 364, p.20-26 (2015)

A. Levy et al., “The creation of large-volume, gradient-free warm dense matter with an x-ray free-electron laser”, **Physics of Plasmas**, 22 (3), 030703 (2015)

M. Hunter et al., “Fixed-target protein serial crystallography with an x-ray free-electron laser”, **Scientific Reports (Nature)** 4, 6026 (2014)

D. Garvey et al., “Development of Next Generation Anomaly Detection & Isolation for GE90 Engines” **GE Report** GRC286 (2014)

M. Frank et al. “Femtosecond X-ray diffraction from two-dimensional protein crystals”, **IUCrJ**, v.1, pt.2, 95 (2014)

C. Weninger et al., “Stimulated Electronic X-ray Raman Scattering”, **Physical Review Letters**,

111, 233902 (2013)

J. Rudolph et al., "X-ray resonant photoexcitation: line widths and energies of K-alpha transitions in highly charged Fe ions", **Physical Review Letters**, 111, 103002 (2013)

S. Bernitt et al., "Tackling the Astrophysical Fe XVII Emission Problem with a Free-Electron X-ray Laser", **Nature** Dec. (2012)

S. Hau-Riege et al., "Ultrafast Disintegration of X-ray-Heated Solids", **Physical Review Letters** 108, 217402 (2012)

N. Rohringer et al., "First Realization of an Atomic Inner-shell X-ray Laser at 1.46 nm Wavelength", **Nature**, 481, 7382, p. 488 (2012)

J. Gaudin et al., "Amorphous to Crystalline Phase Transition in Carbon Induced by Intense Femtosecond X-ray Free-Electron Laser Pulses", **Physical Review B**, 86 024103 (2012)

J. Clementson et al., "Atomic data for the ITER Core Imaging X-ray Spectrometer", **Proc. of the 39th European Physical Society Conference on Plasma Physics** (2012)

J. R. Crespo et al., "Photoionizing Trapped Highly Charged Ions with Synchrotron Radiation", **Proc. for Atomic Processes in Plasmas** (2011)

J. Dunn et al., "Spectroscopic Studies of Hard X-ray Free-Electron Laser-heated foils at  $10^{16}$  Wcm<sup>-2</sup> Irradiances", **SPIE Proc. X-ray Lasers and Coherent X-ray Sources** (2011)

K. Chu et al., "In-plane Rotation Classification for Coherent X-ray Imaging of Single Biomolecules", **Optics Express**, 19, 12, 11691 (2011)

F. Graziani et al., "Large-scale Molecular Dynamics of Dense Plasmas: The Cimarron Project" (**High Energy Density Physics** June issue 2011)

S. Hau-Riege et al., "Interaction of Low-Z Inorganic Solids with Short X-ray Pulses at the LCLS Free-Electron Laser", **Optics Express** 18, 23 p. 23933 (2010)

B. Labombard et al., "Critical Gradients and Plasma Flows in the Edge Plasma of Alcator C-Mod", **Physics of Plasmas**, 15, 056106 (2008)

G. V. Brown et al., "Simulating Cometary and Stellar X-ray Emission in the Laboratory Using Microcalorimeters and an Electron Beam Ion Trap", 14<sup>th</sup> APS Atomic Processes in Plasmas, **AIP Conf. Proc. CP730**, edited by J. Cohen, S. Mazavet, and D. Kilcrease 730, 203 (2004)