

For discussion

# Signalling Bursty Queue Delay

Expt 1.1 basic results

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Feb 2023

Compare 2 marking approaches: Sojourn (s) & EST (e)

# Experiment plans

- 2 unresponsive flows, a & b
- Ideal: marking probability,  $p$ ,
  - monotonically increases with burst size,  $\beta$
  - does not decrease with capacity share,  $\lambda$
- Expt 1.1:
  - For a set of fixed capacity shares  $\lambda_a + \lambda_b = \Sigma\lambda$  (constant)
  - burst size  $\beta$ : increase  $\beta_a$ , decrease  $\beta_b$ , with  $\beta_a + \beta_b = \Sigma\beta$  (constant)
  - measure both marking probabilities,  $p_s$  &  $p_e$
  - for each approach, report mean, max & min of each marking metric over a range of phase shifts
- Control expt 1.2:
  - Same as #1.1, with  $\Sigma\lambda$  and  $\Sigma\beta$  constant
  - but with  $\beta_a = \beta_b$  increase  $\lambda_a$
  - marking should not depend on capacity share,  $\lambda$
- Expt 2.1:
  - Same as #1.1, except hold  $\beta_b$ , while increasing  $\beta_a$
- Expt 3.1:
  - Same as #1.1 except increase  $\beta_a$  with  $\lambda_a$
- Expt 4? Model packetization or use ns3
- Redesign marking?
- Design & Model aggregate policer

# Normalized metrics

Goal: results applicable to any link rate and any step marking threshold delay

- Burst size  $\beta$  is in units of time (queue delay)
  - normalized to: marking threshold = 1 unit of time
- On time series plots, time is also normalized
  - queue delay at marking threshold = 1 unit of time
- Marking rate,  $\lambda p$ , is marked bits per unit time
  - normalized as a dimensionless fraction of link bit rate = 1
- Marking probability,  $p$ , and capacity share,  $\lambda$ 
  - both dimensionless and bounded within  $[0,1]$
  - so normalized marking rate,  $\lambda p$ , also bounded within  $[0,1]$
- Comparison metrics use difference,  $p_a - p_b = \Delta p$ , not ratio  $p_a/p_b$ 
  - not distorted as  $p_b \rightarrow 0$
  - visualization of unresponsive traffic marking, irrespective of any congestion control assumptions

# Expt 1.1

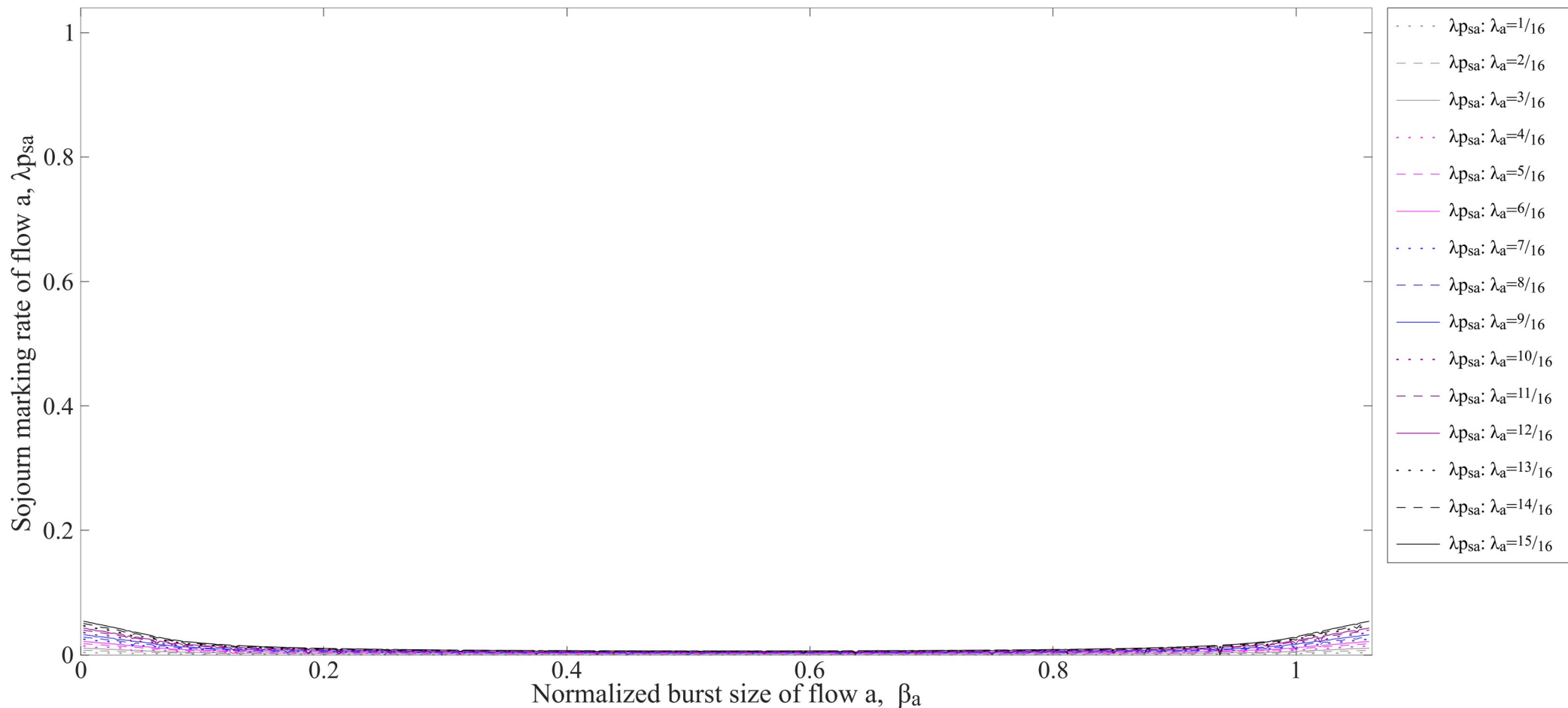
Utilization $\lambda_a + \lambda_b = \Sigma\lambda$	Max burst $\beta_a + \beta_b = \Sigma\beta$	sojourn vs. EST marking			
		$p_a$	$\Delta p$	$\lambda_a p_a$	$\Delta(\lambda p)$
100%	106.25%	••	••	••	••
	125%	••	••	••	••
	225%	••	••	••	••
93.75%	106.25%	••	••	••	••
	125%	••	••	••	••
	225%	••	••	••	••

- This slide introduces the next 6 slides
  - the rest are greyed out
- 4 marking metrics in 4 separate slide packs
  - metrics in other slide packs are greyed out

- $p_a$  : marking probability of flow a
- $\Delta p = p_a - p_b$
- $\lambda_a p_a$  : marking rate of flow a
- $\Delta(\lambda p) = \lambda_a p_a - \lambda_b p_b$

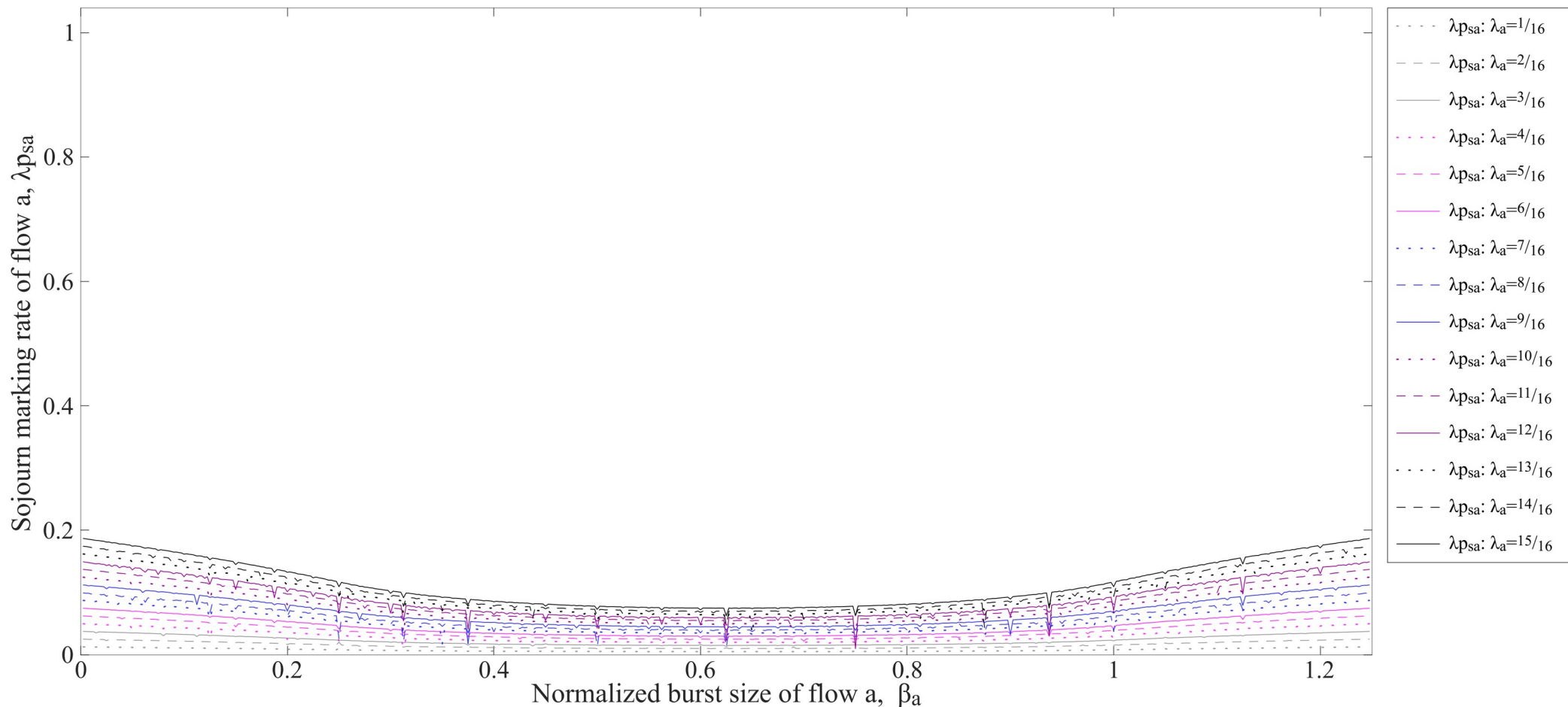
## Sojourn marking with two unresponsive flows, a & b

Capacity fractions,  $\lambda_a$  &  $\lambda_b$  : utilization,  $\Sigma\lambda = 100\%$ ; Burst sizes  $\beta_a$  &  $\beta_b$  :  $\Sigma\beta = 106.25\%$  of marking threshold



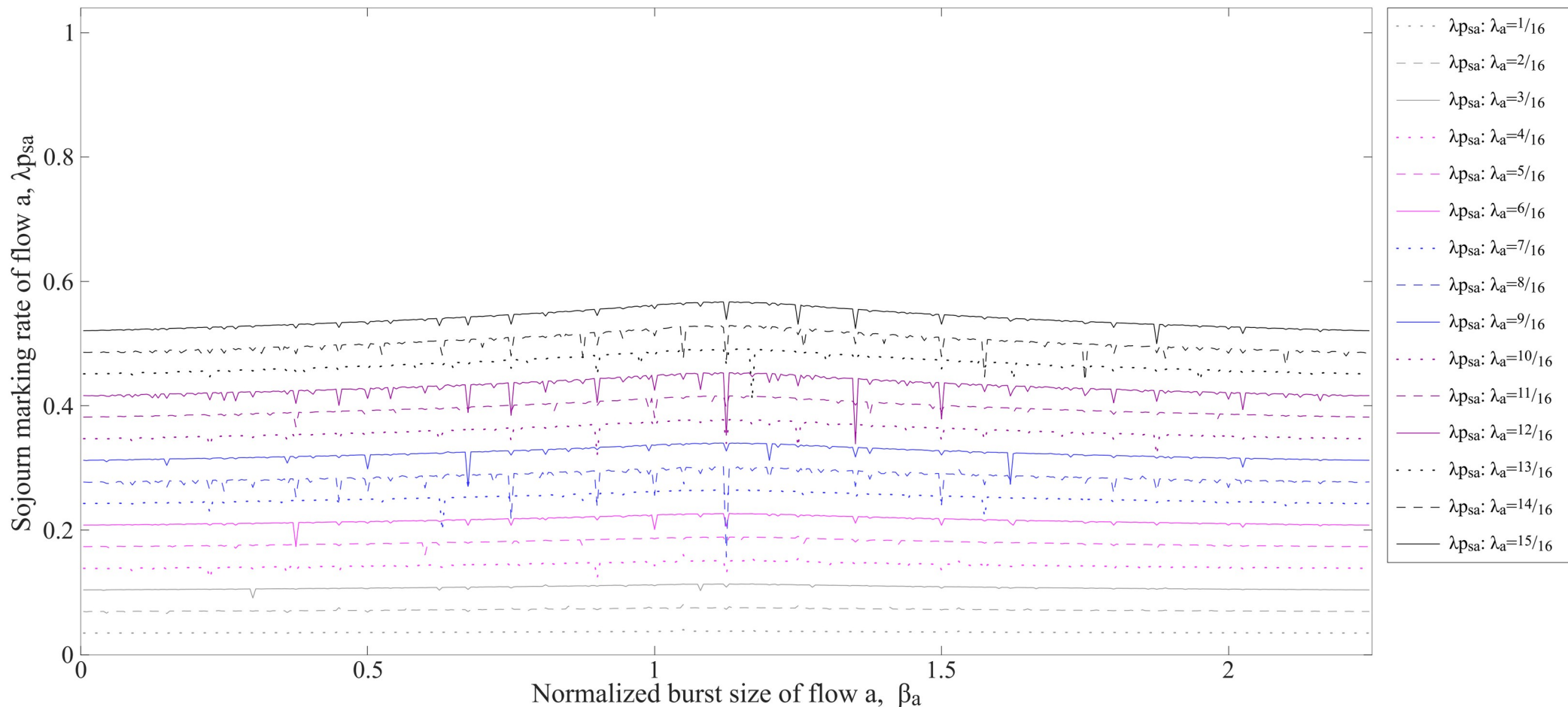
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Capacity fractions,  $\lambda_a$  &  $\lambda_b$  : utilization,  $\Sigma\lambda = 100\%$ ; Burst sizes  $\beta_a$  &  $\beta_b$  :  $\Sigma\beta = 125\%$  of marking threshold



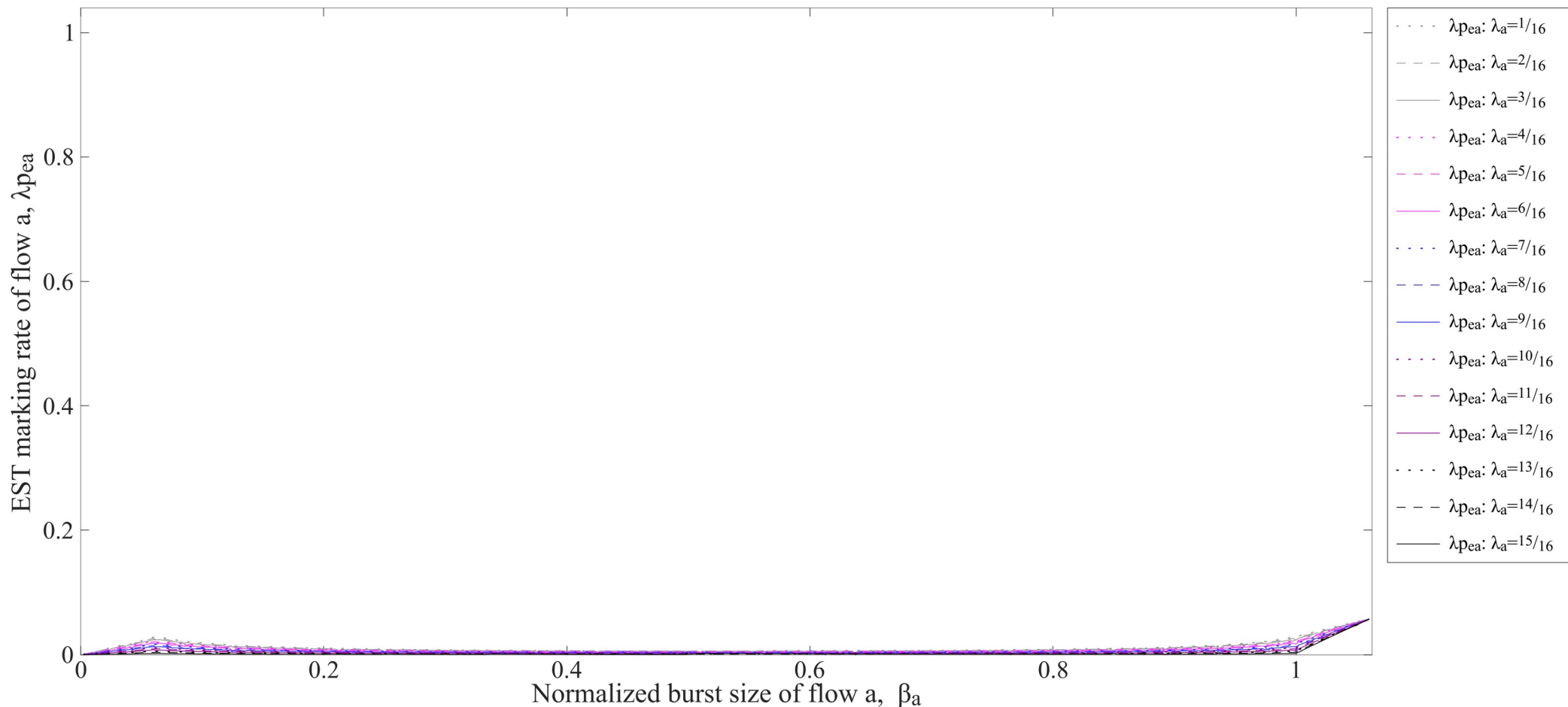
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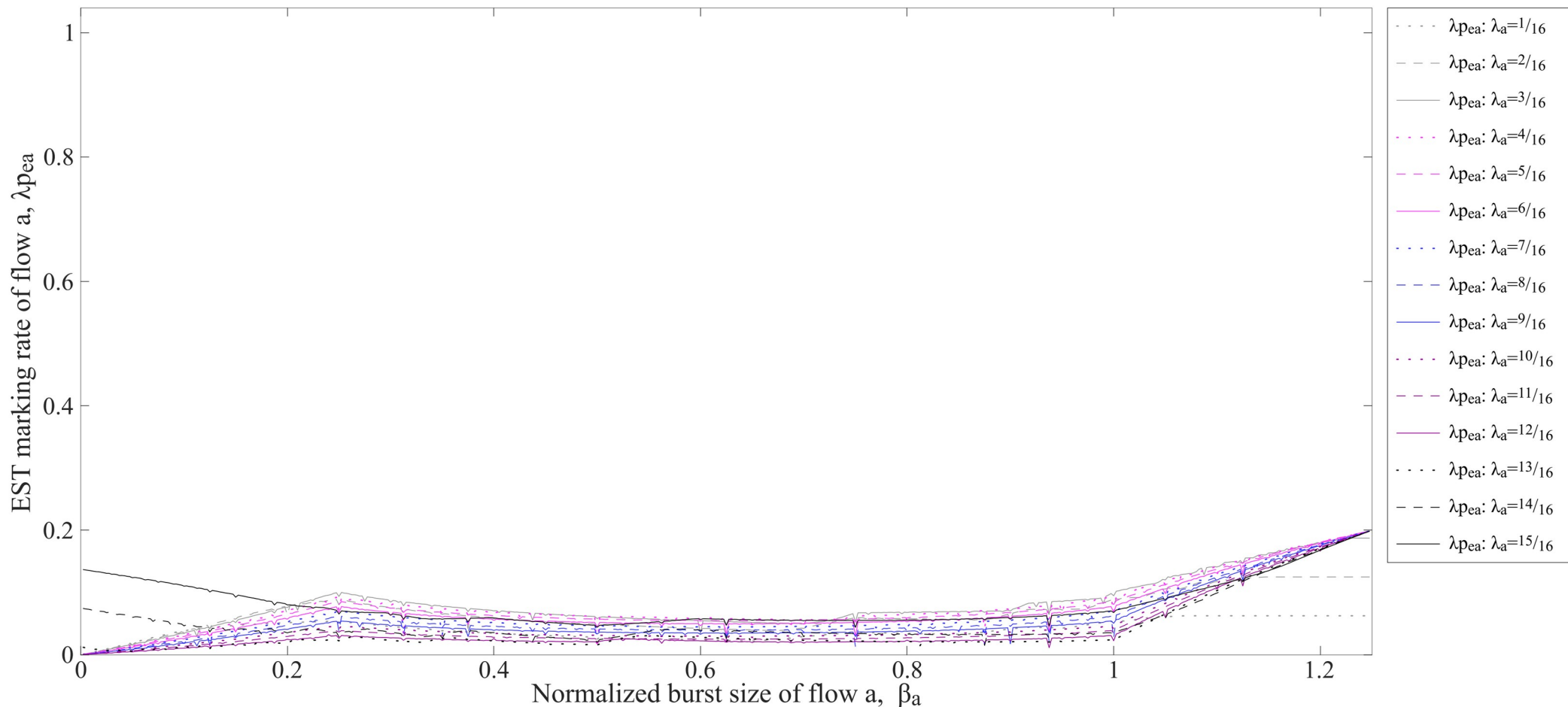
## Expected Service Time (EST) marking with two unresponsive flows, a & b

Capacity fractions,  $\lambda_a$  &  $\lambda_b$  : utilization,  $\Sigma\lambda = 100\%$ ; Burst sizes  $\beta_a$  &  $\beta_b$  :  $\Sigma\beta = 106.25\%$  of marking threshold

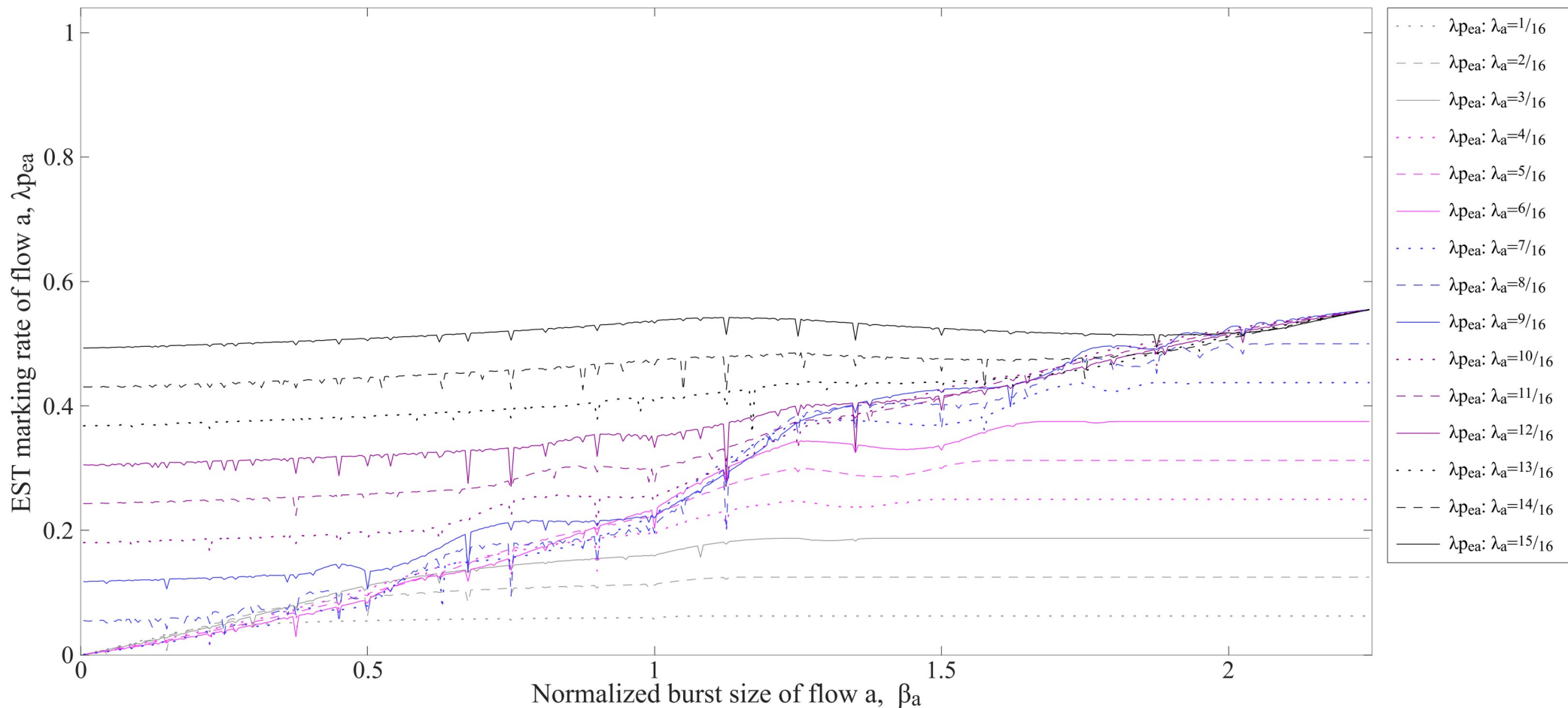




**Expected Service Time (EST) marking with two unresponsive flows, a & b**  
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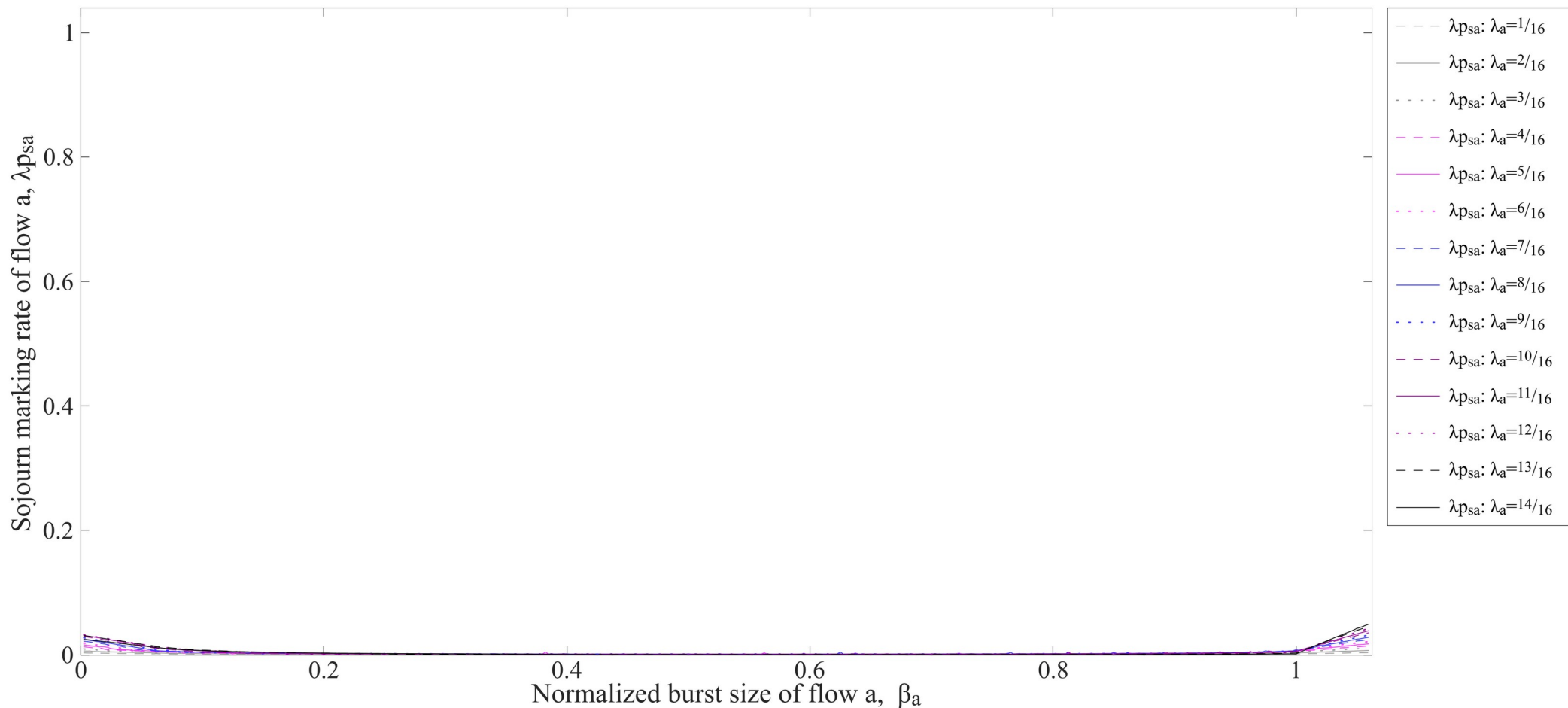
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93.75%	106.25%	..	..	..	..
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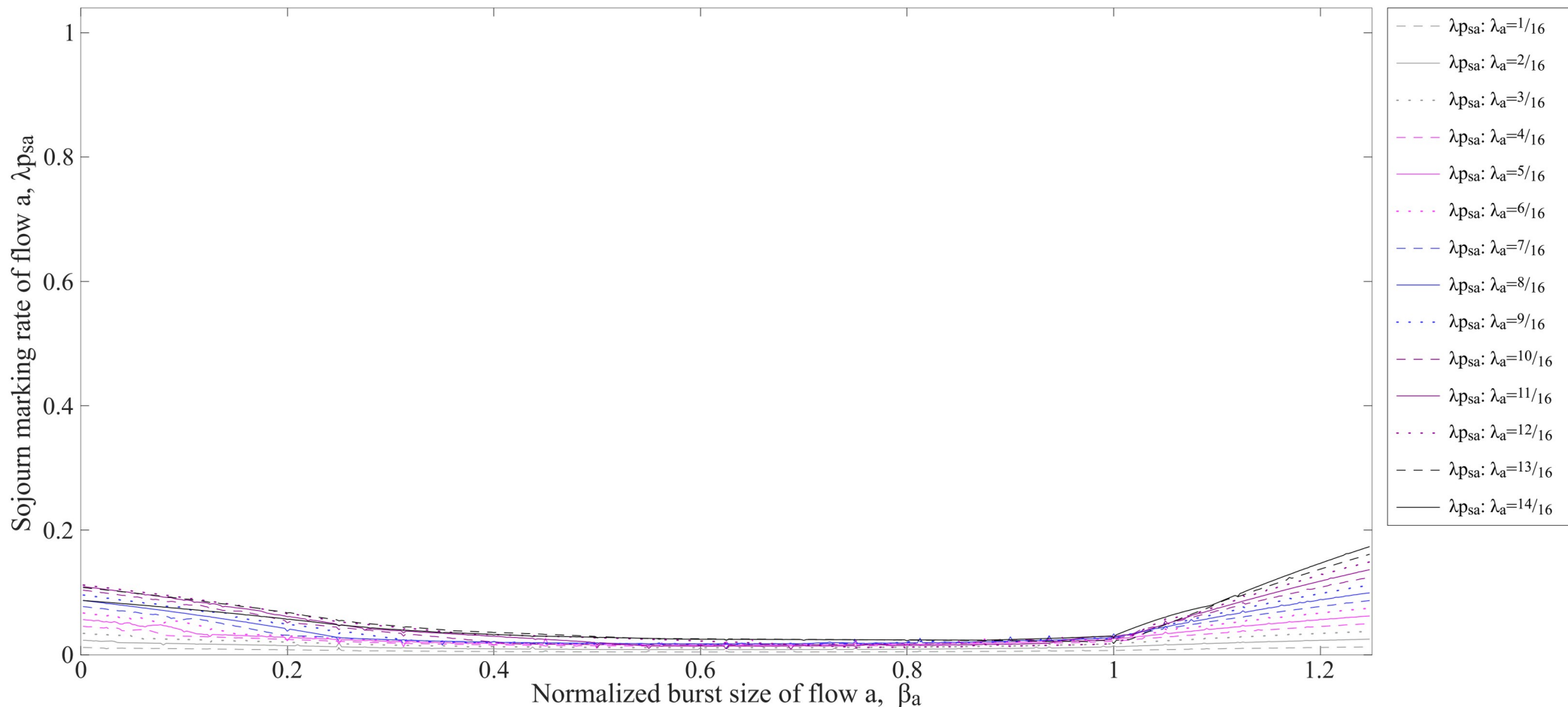
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Capacity fractions,  $\lambda_a$  &  $\lambda_b$  : utilization,  $\Sigma\lambda = 93.75\%$ ; Burst sizes  $\beta_a$  &  $\beta_b$  :  $\Sigma\beta = 106.25\%$  of marking threshold



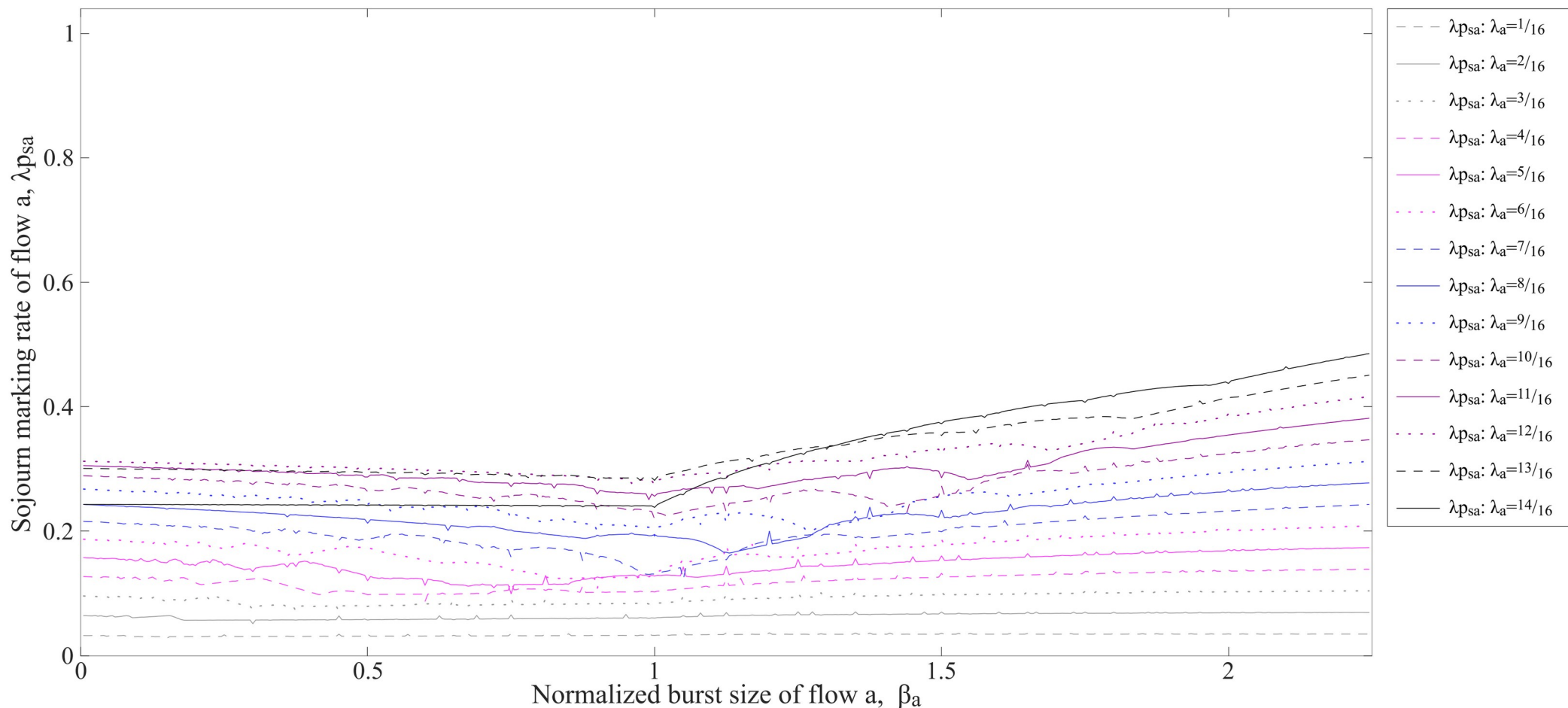
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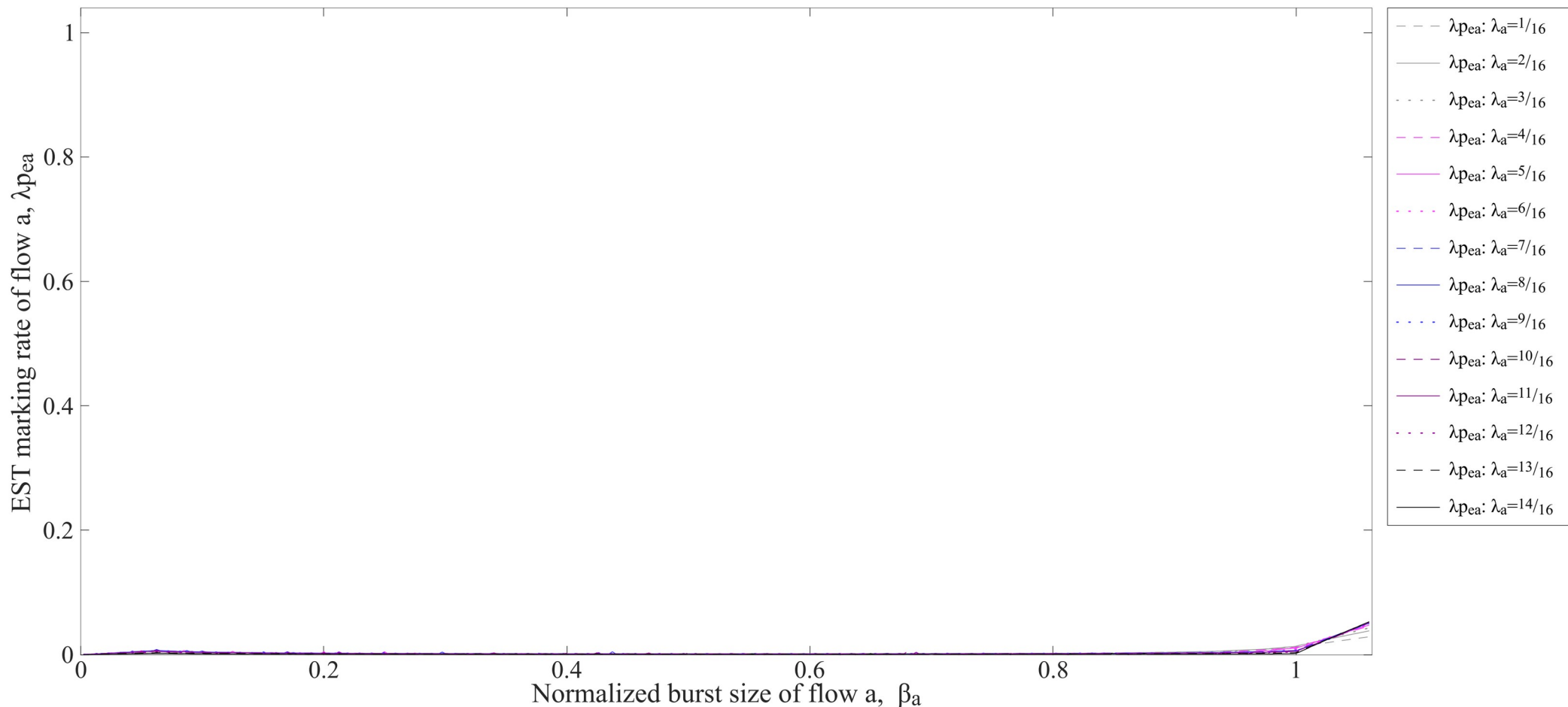


# Sojourn marking with two unresponsive flows, a & b

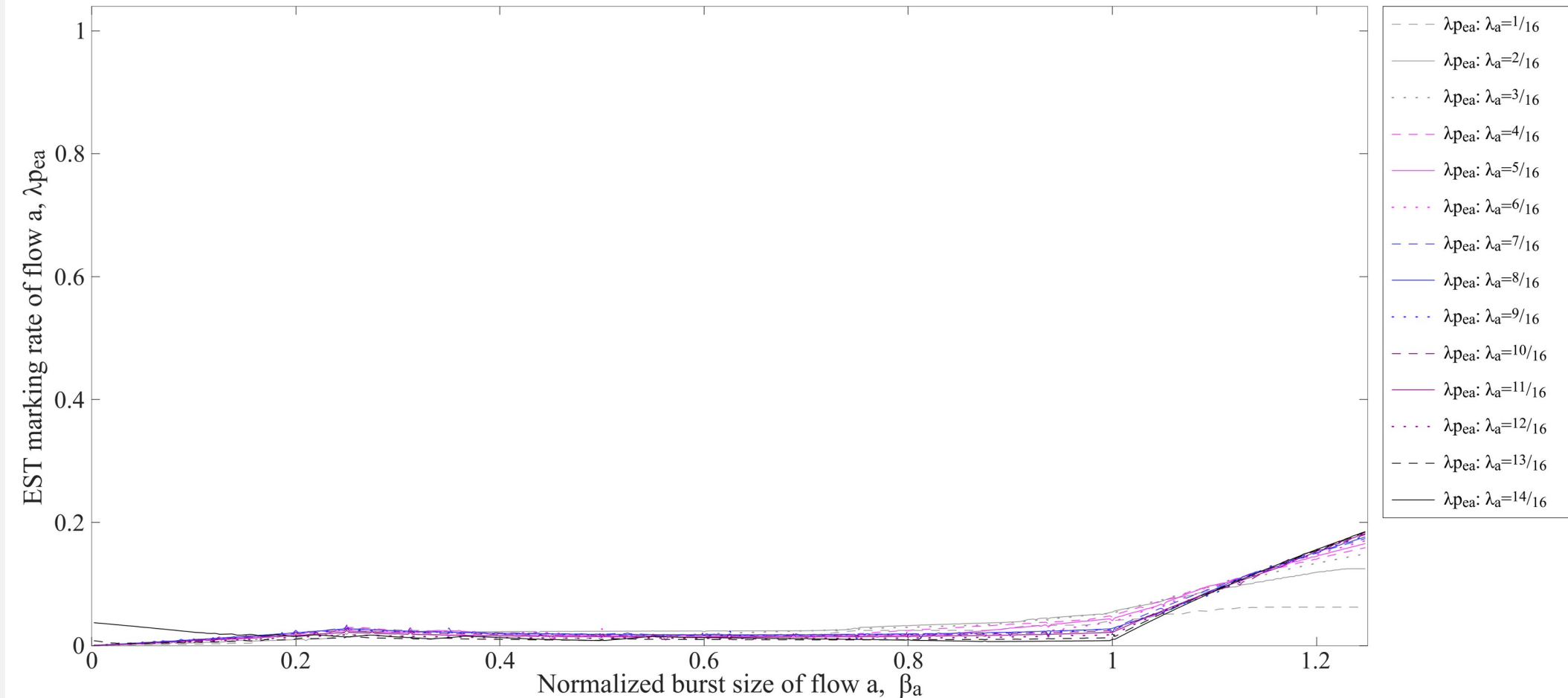
Capacity fractions,  $\lambda_a$  &  $\lambda_b$  : utilization,  $\Sigma\lambda = 93.75\%$ ; Burst sizes  $\beta_a$  &  $\beta_b$  :  $\Sigma\beta = 225\%$  of marking threshold



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